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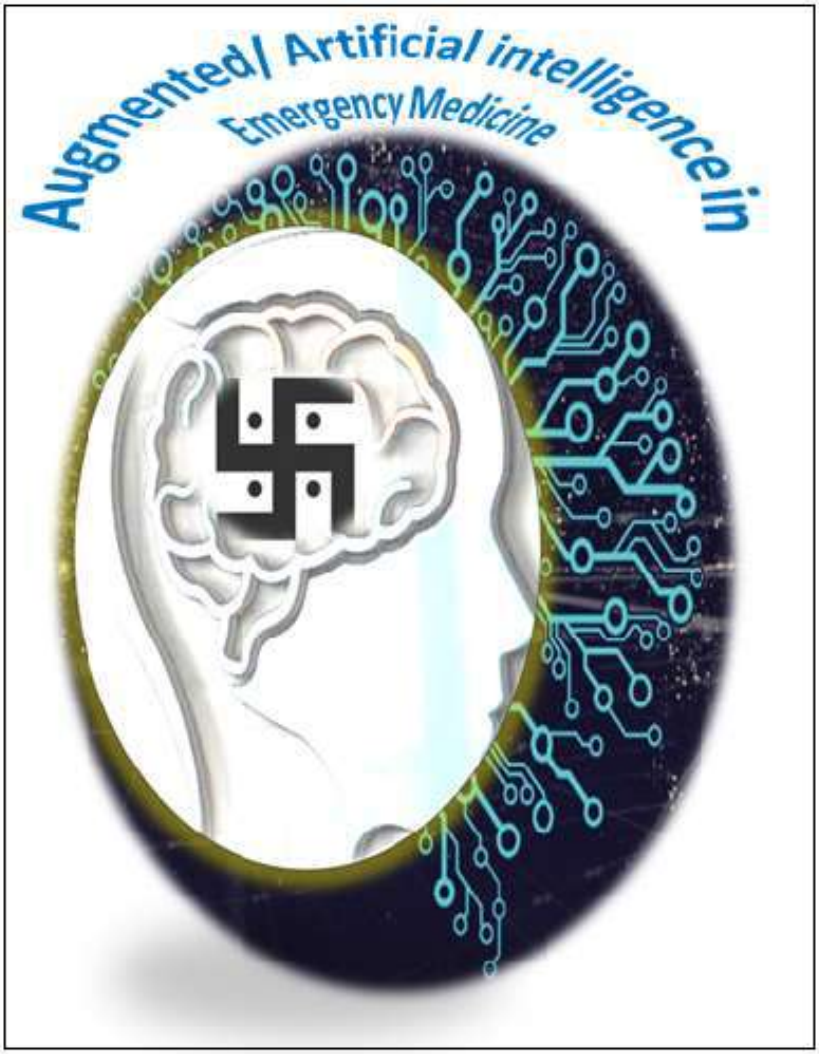

The energy is scattered in the shape of Swastik

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EDITORIAL

Artificial Intelligence and Machine Learning in Emergency Medicine and Intensive Care

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The integration of Artificial Intelligence (AI) into emergency medicine and broader clinical practice has grown in recent years, and this trend is expected to continue. Recent advances in machine learning and natural language processing (NLP) represent significant developments in health informatics, particularly in emergency medicine. These technologies can enhance the efficiency and effectiveness of care, benefiting both healthcare providers and patients. AI has significant potential to enhance the relationship between physicians and patients, evolving it into a '**triadic model'** that includes machines. However, the implementation of new AI technologies demands careful evaluation, legal standards, patient protections, and education for healthcare providers.

Emergency physicians should be aware of both the benefits and the limitations or risks associated with AI. The necessity for rapid decision-making using large amounts of data makes the adoption of quantitative technologies essential in healthcare. However, strict regulatory requirements in the sector must be carefully considered when implementing these technologies. AI has the potential to significantly transform emergency care through various applications. Key uses include AI-assisted symptom checkers to direct patients to the right care settings. Triage models for assigning appropriate care levels. Ambient AI systems that document clinical encounters seamlessly. Tools for creating concise chart summaries and tailored discharge instructions for better patient understanding.

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The management of the emergency department (ED) encompasses various issues—such as operations, logistics, and contingencies—that impact its efficiency

Overcrowding and understaffing in EDs have become prevalent due to a significant rise in demand for services, often exacerbated by seasonal and one-time events associated with health problems that require medical attention. Demand forecasting using traditional statistical methods is challenging due to the high variability and randomness of these events. However, AI methods have demonstrated potential in improving patient load forecasting in EDs. Studies that enable ED staff to accurately predict patient volumes are essential for effective planning and resource allocation. Implementing a comprehensive framework and tools aimed at enhancing operational efficiencies can significantly improve patient care in the emergency department.

There are two main branches of AI applications in emergency medicine:

1. **Diagnostics-specific**: This branch focuses on diagnosis prediction and decision support.
2. **Triage-specific**: This includes applications for predicting mortality, outcomes, admissions, condition severity, and urgent care needs.

Transformative AI is significantly advancing emergency medicine, enhancing practices and improving patient outcomes in several key ways: Enhanced Diagnostic Accuracy

AI algorithms can analyze complex medical data, including imaging and lab results, leading to faster and more accurate diagnoses, which is critical in emergency situations. **Triage Optimization:** AI assists in triaging patients by analyzing symptoms and vital signs, helping prioritize care based on urgency and improving patient flow in busy emergency departments. **Predictive Modeling:** By examining historical data patterns, AI can predict patient outcomes and potential complications, enabling proactive management of high-risk patients. **Clinical Decision Support:** AI systems provide real-time, evidence-based recommendations tailored to individual patient scenarios, aiding clinicians in treatment decisions, especially in unfamiliar cases. **Training and Simulation:** AI creates realistic training scenarios for emergency personnel, enhancing their preparedness for various situations, from trauma to cardiac arrest. **Telemedicine Integration:** Transformative AI improves telemedicine capabilities, facilitating remote consultations and monitoring to ensure timely care when patients cannot visit the emergency room. **Resource Management:** AI optimizes staffing and resource allocation by predicting patient surges and managing supply chain logistics, ensuring efficient operation of emergency departments. **Patient Follow-Up and Care Coordination:** AI helps manage post-emergency care by scheduling follow-ups and coordinating with primary care providers, ensuring continuity of care. **Natural Language Processing:** AI streamlines documentation through voice recognition and automated note-taking, allowing healthcare providers to focus more on patient care instead of administrative tasks. **Ethical Considerations and Compliance:** AI assists in maintaining regulatory compliance and ethical standards by monitoring for potential biases in treatment recommendations and data handling.

Role of Generative AI in Emergency Medicine

Generative AI has the potential to significantly improve patient outcomes and streamline processes in emergency medicine. Generative AI is becoming increasingly important in emergency medicine, offering various potential benefits: **Decision Support:** AI can quickly analyze large volumes of data to provide clinicians with evidence-based recommendations for treatment protocols, triage decisions, and diagnostics. **Predictive Analytics:** By leveraging historical data, generative AI can predict patient outcomes, facilitating better resource allocation and proactive interventions. **Training Simulations:** Generative AI can create realistic training scenarios for emergency medical professionals, enhancing their skills in managing diverse emergencies. **Patient Communication:** AI-powered chatbots can assist in communicating with patients and their families, providing information about treatment plans and answering common questions. **Image Analysis:** In emergencies, AI can facilitate rapid image analysis (e.g., X-rays, CT scans), improving the speed and accuracy of diagnoses. **Resource Optimization:** AI helps manage logistics in emergency departments by predicting patient influx and optimizing staff allocation. **Telemedicine Support:** Generative AI enhances telemedicine services, enabling remote consultations and monitoring for patients needing urgent care. **Data Integration:** AI synthesizes information from various sources (medical history, lab results, etc.) to provide a comprehensive view of a patient's condition.

Pre-Hospital Emergency Care & wearable devices

Wearable devices are becoming increasingly valuable in pre-hospital emergency care by providing real-time data and improving patient outcomes in several ways: **Vital Sign Monitoring:** Continuously tracks vital signs like heart rate, blood pressure, oxygen saturation, and temperature, aiding paramedics in on-site assessments. **Remote Patient Monitoring:** Transmits health data to emergency medical services (EMS) or hospitals, allowing healthcare professionals to prepare for a patient's arrival and make informed treatment decisions. **Activity and Fall Detection:** Equipped with sensors to detect falls or unusual activity patterns, these devices can trigger alerts to emergency responders, particularly benefiting elderly patients. **Medication Management:** Reminds patients to take medications and alerts responders about missed doses, providing crucial context for care. **Location Tracking:** GPS-enabled wearables help EMS locate patients quickly, especially in remote or crowded areas, enhancing response times. **Integration with Health Records:** Links to electronic health records allow paramedics to access medical history, allergies, and previous conditions, facilitating better-informed care. **Telehealth Capabilities:** Supports real-time consultations between paramedics and doctors during patient transport. **Data Analytics:** Collects and analyzes health data over time, providing insights into trends that inform pre-hospital interventions and long-term care strategies. **Enhanced Communication:** Facilitates efficient communication between patients and emergency responders, enabling quick relaying of patient information. **Training**

and Simulation: Used in training scenarios for emergency responders, simulating various patient conditions and responses. Overall, wearable devices are transforming pre-hospital emergency care, leading to improved patient outcomes and more efficient emergency response systems. However, ensuring data security and patient privacy remains a critical concern as these technologies are implemented.

Current research mainly focuses on using AI to predict patient triage levels, acuity, and disposition, as well as to detect acute conditions like sepsis and myocardial infarction. However, some critical areas remain underexplored. One significant gap is the application of AI for patients who require medical care but have not yet received it. This period can lead to patients being unattended for long durations, worsening their conditions and possibly requiring urgent intervention.

Additional applications of AI involve:

- Medical decision-making tools based on clinical guidelines.
- Real-time predictive models for clinical deterioration or sepsis.
- Efficient extraction of unstructured data for coding, billing, research, and quality improvement.

While AI presents many benefits, it also raises concerns regarding privacy, data accuracy, and the potential effects on the doctor-patient relationship.

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ORIGINAL ARTICLE

Retrospective Analysis of the Anti Spitting Laws in Various Geographical Locations and Implementing Sectors in India

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Abstract

Objective: Public spitting attributable to Smokeless Tobacco (SLT) use not only causes a threat to public cleanliness but also to the people exposed around them. An electronic search on various anti-spitting laws and ban in India was done using Google search engine for duration of three months (November 2018 to January 2019). Material and Methods: The original state gazettes were reviewed to extract the data on spit ban and penalty. Renewals of Acts were also thoroughly checked for recent updates of penalty or severity of the act. The law implementing bodies were broadly classified as National, State, Municipal, Village councils (Gram Panchayat), Airports, Metro Railway, and Company Law Tribunal. Results: A total of 42 Anti-spitting laws were identified in this search and 16 states had anti spitting law under different sectors. Discussion: Under these laws, sign boards and warnings are placed commonly at Airports, Railway stations, and metro stations. States with high rates of SLT users like Tripura, Arunachal Pradesh and Mizoram did not have any policy on spitting. Conclusion: Strong enforcement of anti-spitting laws in India will not only reduce spread of communicable diseases but also indirectly will reduce the act of using SLT also.

Keywords: Law enforcement, Tobacco Use Cessation, Retrospective Studies, Public Health Practice, Health Policy

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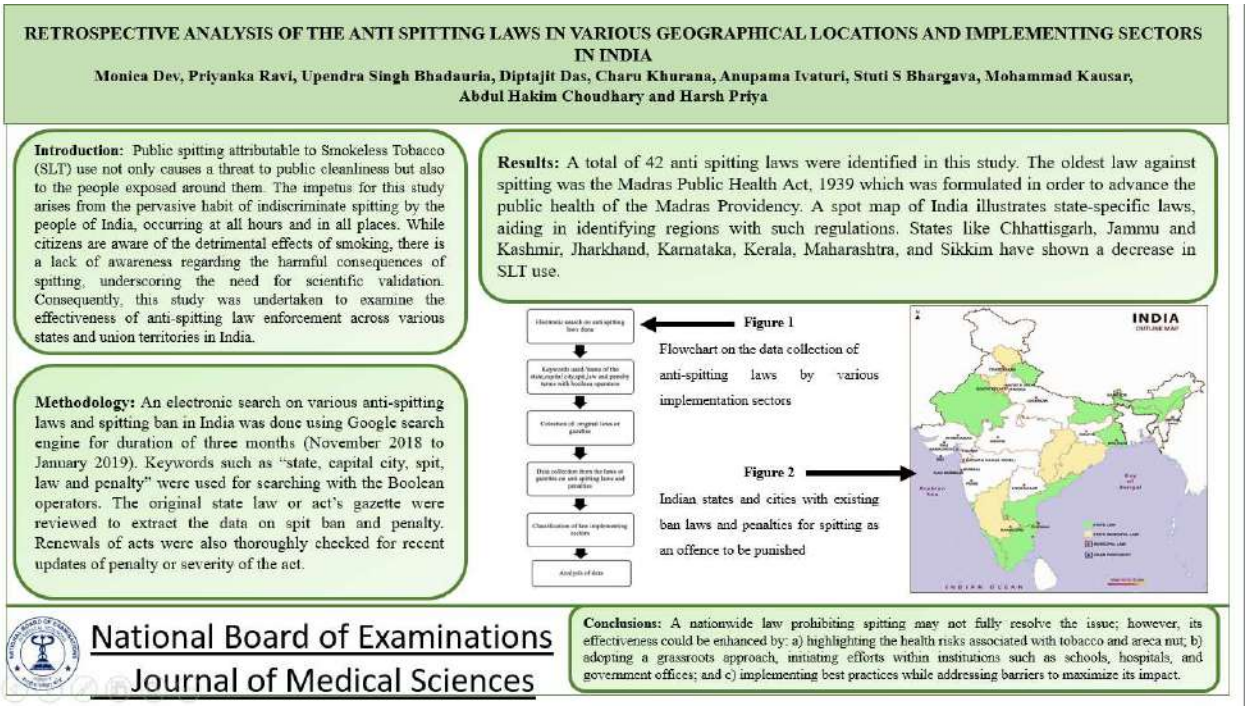
Graphical Abstract



Introduction

The tobacco epidemic is one of the greatest public health threats globally, causing the deaths of over 8 million tobacco users annually [1]. The Indian Global Adult Tobacco Survey (GATS)-2 (2016-2017) reports that 266.8 million (28.6%) adults currently use tobacco either as smoking or Smokeless Tobacco (SLT) form. Adult tobacco users account to 21.4% of which 29.6% are males and 12.8% are females. The prevalence of tobacco use has decreased by six percentage points, from 34.6% in GATS-1 (Global Adult Tobacco Survey) to 28.6% in GATS-2 [2].

The consumption of SLT involves either chewing, swallowing or spitting. One of the most unhygienic human practice which can lead to the spread of airborne diseases like bronchitis, pneumonia or tuberculosis (TB) is spitting [3]. A campaign about the spread of tuberculosis started against public spitting of sputum in households in the 1880s [4]. In the year 1918, spitting in public places was considered an offense in the West due to the deadly outbreak of influenza [5].

Countries like Bangladesh, India, and China in the SEAR, where exposure to public spitting is common, have shown high rates of TB and adverse health consequences [6]. A vessel meant for spitting, known as a spittoon, was a common sight during the Mughal period and can still be seen in some homes in India, where the spittoon is used to spit out betel leaf juice or paan. The unaesthetic spit marks leave near-permanent spots that are dirty brown from gutka spit or red with betel quid spit [4]. Psychiatrists consider spitting a culture-specific or culture-bound syndrome (CBS), which refers to a set of psychiatric and somatic symptoms recognized as a distinct disease only within a particular society or culture [7].

The issue of spitting was brought up in the Indian Parliament under the term "Great Indian Spit." Members of Parliament suggested that the Health Ministry of India conduct scientific studies on the matter [8]. The report from the Expert Group Consultation on SLT and Public Health in WHO (World Health Organization) for the South-East Asian Region (SEAR) countries recommended the enforcement of anti-spitting laws in India. Public spitting, primarily due to the chewing of tobacco and paan (betel quid), poses a significant challenge to maintaining public hygiene [9].

The prohibition on spitting in public places has been enacted with various intentions in different parts of the world [10]. Anti spitting legislations have been framed by Indian government for various reasons namely to maintain the cleanliness of public properties, to prevent spread of airborne communicable diseases. These laws will have dual effect as a precursor to ban SLT. Evaluation of data on anti-spitting laws in India should be checked to understand which region has to be given more attention for the better formulation of such laws [11].

The impetus for this study arises from the pervasive habit of indiscriminate spitting by the people of India, occurring at all hours and in all places. While citizens are aware of the detrimental effects of smoking, there is a lack of awareness regarding the harmful consequences of spitting, underscoring the need for scientific validation. Consequently, this study was undertaken to examine the effectiveness of anti-spitting law enforcement across various states and union territories in India.

Materials and Methods

An electronic search on various anti-spitting laws and spitting ban in India was done using Google search engine for duration of three months (November 2018 to January 2019). Keywords such as "state, capital city, spit, law and penalty" were used for searching with the Boolean operators (Figure 1). The original state law or act's gazette were reviewed to extract the data on spit ban and penalty. Renewals of acts were also thoroughly checked for recent updates of penalty or severity of the act.

Figure 1. Flowchart on the data collection of anti-spitting laws by various implementation sectors

Data was gathered on several aspects, including the implementing body, name of the act, approval status, monetary penalties, year of enactment, mandatory community service requirements, severity based on frequency, rationale for the law, anticipated outcomes, levels of previous attempts, evaluation methods, implementers, innovative punishment measures, and specifications regarding tobacco. The various law enforcement bodies were broadly categorized as national laws, state and union

territories, municipal corporations, village councils (gram panchayats), and the National Company Law Tribunal.

Results

A total of 42 anti spitting laws were identified in this study. The oldest law against spitting was the Madras Public Health Act, 1939 which was formulated in order to advance the public health of the Madras Providency [12]. The various anti-spitting laws were grouped under the subsequent levels (Table 1).

Table 1. Anti spitting laws in India

CATEGORIES	NAME OF THE LAWS	YEAR
National level laws	Swatch Bharat Mission (Clean India Mission)	2016
	Indian Railways	2012
State laws	Uttarakhand	1950
	Rajasthan	1956
	Andhra Pradesh	1965
	Goa	1976
	Kerala, Sikkim	1980
	West Bengal, Nagaland	1994
	West Bengal	1997
	Meghalaya	2001
	Tamil Nadu	2002
	Himachal Pradesh	2003
	Punjab, Haryana	2006
	Madhya Pradesh	2013
	Karnataka	2015
	Odisha	2016
Cities/Municipal	Imphal	1866
	Mumbai (Police act)	1950
	Navi Mumbai	1955
	Chennai	1960
	Nagpur	1961
	Pune	1980
	Chandigarh	1999
	Ranchi	2010
	Hyderabad	2011
	Bangalore	2012
	Ahmedabad	2015
	Surat, Diu	2016
	Dadra and Nagar Haveli, Kolkata, Chhattisgarh	2017

	Meghalaya (Police act), Calcutta Police Act	2018
Airports	All airports	2003
Metro railways	Delhi, Kolkata, Chennai, Jaipur, Kochi, Lucknow, Bangalore	2002
Hyderabad Metro railways	Hyderabad	2017
Village	Raj Samadhiyala	2012
11 Benches Court	National Company Law Tribunal Companies Act 2013 and Insolvency and Bankruptcy Code	2016

National Level anti-spitting Laws

National-level anti-spitting regulations have a pan-India impact, enforcing the cessation of public spitting across all regions and against any violators throughout the country. The Swachh Bharat Mission Draft Model Municipal Solid Waste Management Rules, 2016, classifies spitting in public spaces as creating a public nuisance, punishable by a fine of ₹250 [13].

The Indian Metro Railways, Indian Railways, and airports consider spitting a punishable offense, imposing fines and maintaining high surveillance along with prominently displayed warning signs. Indian Railways spends crores of rupees annually on cleaning and scrubbing spit marks [14]. To enforce these rules, the railway administration employs flying squads, station masters, and ticket collectors from the commercial and equivalent operating departments [15].

State Level anti-spitting Laws

A total of 16 states have implemented anti-spitting laws across various sectors. This section discusses the specific laws and their motivations for formulation. The **Tamil Nadu Prohibition of Smoking and Spitting Act, 2002** was established to prohibit smoking and spitting in public places and vehicles within the state [16]. The **Uttarakhand Anti-Littering and Anti-Spitting Act, 2016** aims to keep the state clean and pollution-free [17]. The **Rajasthan Prevention of Defacement of Property Act, 2015** [18] was enacted for public cleanliness. The **Goa Prohibition of Smoking and Spitting Act, 1997** [19] bans smoking and spitting. In **Kerala [4]**, laws address public spitting and nose-blowing. **Sikkim's "Green Mission"** [20] seeks to create green belts across the state. The **West Bengal Prohibition of Smoking and Spitting and Protection of Non-Smokers and Minors Act, 2001** [21] aims to prohibit tobacco use in all forms. The **Nagaland Municipal Act, 2001** [22] focuses on cleanliness, while the **Himachal Pradesh Municipal Corporation Act, 1994** [23] prohibits nuisances in public spaces. The **Madhya Pradesh Municipal Corporation Act, 1956** [24] educates people about hygiene and cleanliness. Lastly, the **Chandigarh Municipal Corporation (Sanitation and Public Health) Bye-Laws** [25] address sanitation and public health.

In 2018, the government of Dadar and Nagar Haveli was the most recent to classify spitting as a public nuisance [26]. The Odisha Municipal Corporation has implemented a

creative strategy to discourage spitting by placing images of deities on ceramic tiles [27]. To curb airborne diseases, the government of Maharashtra imposes a fine of ₹1,000, along with five days of community service and possible suspension of licenses [28]. Rajasthan has the highest penalty for spitting offenses, with fines up to ₹5,000 and a possible two-year imprisonment [18]. Conversely, Meghalaya has the lowest penalty, with a fine of ₹5, set in 1980 without any subsequent revisions [29].

Municipal Level

The **Indore Municipal Corporation Act** [30] of 1956 prescribes punishments for spitting offenses ranging from imprisonment to community service. According to the annual Swachh Survekshan survey on cleanliness, hygiene, and sanitation in Indian cities and towns, Indore has been declared the "cleanest city" [31]. The law allows for the public naming of offenders in newspapers and permits school students and corporation employees to report violators. The government of Indore actively educates citizens on the importance of hygiene and maintaining cleanliness in public spaces. Citizens can report offenses using the 311 Indore Metropolitan Corporation (IMC) app [32], and authorities can instruct habitual offenders to carry a spittoon.

The **Municipal Corporation of Lucknow** has installed CCTV cameras in public areas to monitor lawbreakers [33]. In 2017, the **Pune Municipal Corporation Act [34]** described spitting as an offense to maintain municipal cleanliness. Under the Draft Solid Waste Management Bye-Laws 2016, the **Chennai Municipality [13]** classifies spitting as a public defacement offense. Similarly, the **Navi Mumbai Municipal Corporation Cleanliness and Sanitation Bye-Laws 2017** [35] and the **Imphal Municipal Council (Cleanliness and Sanitation) Bye-Laws 2011** [36] designate spitting as an offense for maintaining cleanliness and sanitation.

An amendment to Section 338 of the **Kolkata Municipal Corporation (Second Amendment) Act**, passed in the Assembly on November 22, 2018, has increased penalties for littering. The revised bill proposes a minimum fine of ₹5,000 and a maximum penalty of ₹1 lakh, replacing the previous penalties of a minimum of ₹50 and a maximum of ₹5,000.

Under the **Mumbai Police Act**, offenders can be charged under Sub-section (1) of Section 33 of the **Bombay Police Act, 1951 [38]**, which includes imprisonment. In 2007, Gangtok in the state of Sikkim [20] was declared a spit-free zone to minimize pollution as part of the state's Green Mission initiative.

Village Level

Established through a constitutional amendment in 1992, Panchayati Raj in India builds upon the traditional panchayat system of the Indian subcontinent and serves as a framework for local self-government. The village of Raj Samadhiyala in Gujarat has been recognized as a model village for its exemplary implementation of this system. In 2005, the Union Ministry of Rural Development awarded the village the Nirmal Gram Puraskar (Clean Village Award) [39]. The village head collects fines from offenders and saves them as a fixed deposit

in a bank, allowing cleanliness drives to be initiated without waiting for government funds.

The Company Law Tribunal

The National Company Law Tribunal (NCLT) in New Delhi was established to adjudicate corporate civil disputes arising from the Companies Act 2013 and the Insolvency and Bankruptcy Code 2016 which stated that spitting is strictly prohibited in order to keep the court buildings clean [40].

Barriers

The challenges in enforcing the laws included cultural factors, an undefined implementation authority, political interference, arrogance from those in charge, officials operating in plain clothes without identification, and the absence of a clear evaluation strategy.

Authoritative Personnel to Monitor

The individuals responsible for overseeing offenses include government officials, cleanup marshals [41], sanitation inspectors and workers [42], nodal officers [43] from the forest environment and wildlife management department, the chief officer of the municipality [26], civic cops, the municipal squad [35], school students [24], private security personnel, nuisance detectors or implementing authorities [44], and gram panchayat members [45]. The implementing body and name of the acts mentioning spitting as an offence and punishable act are given in Annexure 1.

Discussion

Tobacco control presents a formidable public health challenge in India, prompting the Government to implement a range of policies at both national and sub-national levels. While over seventy-five bodies have recognized spitting as an offense, only ten have specifically addressed tobacco-related spitting [46].

In 2005, Goa led the way by becoming the first state to impose a complete ban on the consumption, sale, and storage of gutka. By January 2013, 17 additional states and four union territories had enacted similar legislation banning the manufacture, sale, and use of gutkha. In May 2013, the Ministry of Health & Family Welfare implemented food safety regulations enforcing a nationwide ban on gutkha, a mixture of areca nut and tobacco [47]. By 2019, states including Delhi, West Bengal, Bihar, Rajasthan, Uttarakhand, and Maharashtra had banned the sale of gutkha and pan masala. Notably, Uttarakhand imposed a total ban on the manufacture, storage, distribution, and sale of products like gutkha and pan masala, which contain high levels of tobacco and nicotine. Despite the Food Safety and Standards Authority of India prohibiting tobacco and nicotine in products for human consumption, gutkha, pan masala, and similar items continue to be sold with high tobacco and nicotine content [48]. The Swachh Bharat Mission has sought to influence public attitudes and behaviors regarding cleanliness [49].

Tobacco-specific anti-spitting laws are enforced by various entities, including Uttarakhand [17], Kolkata [37], Tamil Nadu [16], Mumbai police [38], airports [50], metro railways [51], Indian Railways [15], and East Coast Railways. A comparison with the Global Adult Tobacco Survey 2016-2017

reveals that states with high rates of smokeless tobacco (SLT) use, such as Tripura, Arunachal Pradesh, and Mizoram, lack specific anti-spitting laws (Table 2). A spot map of India (Figure 2) illustrates state-specific laws, aiding in identifying regions with such regulations. States like Chhattisgarh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Maharashtra, and Sikkim have shown a decrease in SLT use.

Table 2. State wise comparison of GATS2 smokeless tobacco use in percentage with existence of anti-spitting laws at state level (2016-2017)

S.NO	**Name of the state**	**GATS* 1 Smokeless tobacco use in percentage 2009-2010**	**GATS* 2 Smokeless tobacco use in percentage 2016-2017**	**State**	**Municipality**	**Village**
1	Andhra Pradesh	11.8	7.1		Exiting law	Nil
2	Arunachal Pradesh	18.3	39.3	Nil	Nil	Nil
3	Assam	24.9	41.7	Petition given in 2016	Nil	Nil
4	Bihar	39.3	23.5	Yes	Nil	Nil
5	Chhattisgarh	40.6	36	Nil	Yes	Nil
6	Goa	4	6.5	Yes	Nil	Nil
7	Gujarat	18.4	19.2		Yes	Yes
8	Haryana	4.1	6.3		Yes	
9	Himachal Pradesh	2.9	3.1		Yes	

10	Jammu and Kashmir	4.7	4.3	Nil	Nil	Nil
11	Jharkhand	40.5	35.4	Yes		Nil
12	Karnataka2015	16.3	16.3	Yes	Yes	Nil
13	Kerala	8.1	5.4	Yes	Nil	Nil
14	Madya Pradesh2013	22.6	28.1	Nil	Yes	Nil
15	Maharashtra	24.8	24.4	Nil	Yes	Nil
16	Manipur	28.5	47.7	Nil	Nil	Nil
17	Meghalaya	19.5	20.3			
18	Mizoram	27.5	33.5	Nil	Nil	Nil
19	Nagaland	25.3	39	Nil	Yes	Nil
20	Orissa2016	35.9	42.9	Nil	Yes	Nil
21	Punjab	4.8	8.0	Nil	Yes	Nil
22	**Rajasthan**	**13.5**	**14.1**	**Yes**	**Nil**	**Nil**
23	Sikkim	15.2	9.7	State program		
24	Tamil Nadu	6.6	10.6	Yes		
25	Telagana(Hyderabad 2011)		10.1		Yes	
26	Tripura	28.6	48.5	Nil	Nil	Nil
27	Uttaranchal	8.6	12.4	Nil	Nil	Nil

28	Uttar Pradesh	19.1	29.4		Yes	
29	West Bengal	15	20.1		Yes	
	Name of the union territory					
1.	Andaman and Nicobar Islands			Nil	Nil	NIL
2.	Chandigarh	3.3	6.1		Yes	
3.	Dadar and Nagar Haveli				Yes	
4.	Daman and Diu				Yes	
5.	Delhi	6.9	8.8		Yes	
6.	Lakshadeep			Nil	Nil	Nil
7.	Pondicherry	4.8	4.7	Nil	Nil	Nil

*GATS-Global Adult Tobacco Survey

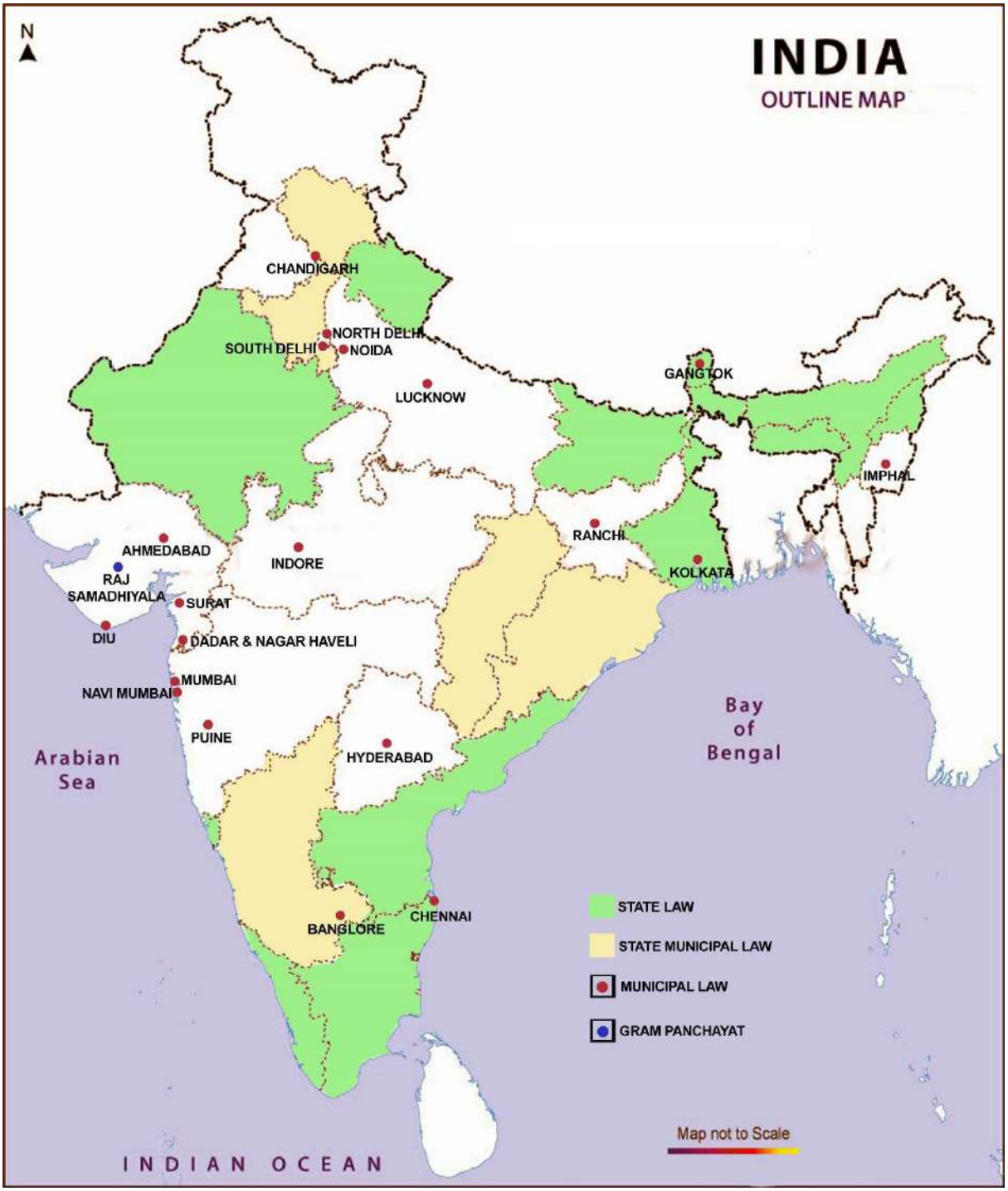


Figure 2. Indian states and cities with existing ban laws and penalties for spitting as an offence to be punished

The prevalence of SLT use decreased significantly from 25.9% in GATS 1 to 21.4% in GATS 2, a relative reduction of 17.4% [52]. This decline is consistent across various demographic groups, including gender, urban or rural residency, age, and tobacco consumption types.

Established in 2006, the International Tobacco Control Policy Evaluation Project in India (TCP India Project) has assessed the psychosocial and behavioral impacts of tobacco control laws in Maharashtra, Bihar, Madhya Pradesh, and West Bengal using methodologies akin to those employed globally.

Implementing a ban on spitting in public places is recommended as a public health policy to indirectly reinforce tobacco control strategies. Evidence from Thailand's tobacco cessation interventions, which include spitting bans in public places and hospitals, suggests potential reductions in oral tobacco use. Similar spitting bans in metropolitan cities in Bangladesh and various states in India demonstrate effective regulatory frameworks for tobacco control [53].

In a petition hearing regarding fines for spitting in Mumbai, the Bombay High Court observed that spitting is a prevalent behavior and highlighted the issue with red-stained walls commonly featured in traveler photos. In Mumbai [54] alone, fines totaling ₹2.24 crore were collected within six months in 2011. Despite 180 countries endorsing the WHO Framework Convention on Tobacco Control (FCTC) as the optimal strategy for managing tobacco demand and supply, only 138 parties (77%) have officially included SLT in their statutes [55].

Unlike the smoking prohibition mandated by Article 8 of the FCTC, no equivalent provision addresses spitting, despite the recognized risks associated with second-hand smoke exposure. The need for targeted policies is underscored by the lack of scientific evidence on the dangers of public spitting and its environmental impact [56].

From 2008 to 2014, the Tobacco-free Village (TfV) program aimed to achieve "tobacco-free" status in 60 villages across Maharashtra. By 2014, four villages met the 11 assessment criteria for this status. The program, in partnership with a community-based organization, demonstrated that community-driven initiatives can support public health goals, especially in resource-limited settings [57].

Overall, states have adopted varying degrees of success with tobacco control policies. Effective policy implementation, coupled with community and civil society initiatives, is crucial for reducing tobacco use prevalence nationwide [58].

The study's limitations include a lack of detailed information on the implementation of quoted laws, exclusion of grey literature, and reliance on some newspaper articles. Future research should compare Indian anti-spitting laws with those of other countries and develop a checklist for formulating effective anti-spitting legislation. It is recommended that the WHO FCTC include spitting of tobacco as an offense alongside smoking.

Conclusion

A nationwide law prohibiting spitting may not fully resolve the issue; however, its effectiveness could be enhanced by: a)

highlighting the health risks associated with tobacco and areca nut; b) adopting a grassroots approach, initiating efforts within institutions such as schools, hospitals, and government offices; and c) implementing best practices while addressing barriers to maximize its impact. The public health policy implementation strategy like time and age-adjusted IEC development, observance and celebration of National Anti-Spitting Day would also help in curbing the health-menace of spitting.

What this paper adds

This is the first study to comprehensively review the existing anti spitting bans across various parts of India and also showcases the best practices followed. The spot mapping of Indian states with existing anti spitting laws, anti-spitting laws in draft are done. A detailed tabulation of various law implementing sectors of India with geographical location was done.

Statements and Declarations

Conflicts of interest

The authors declares that they do not have conflict of interest.

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Annexure 1. Implementing body and name of the acts mentioning spitting as an offence and punishable act

S.NO	Implementing Body	Name of the Act	Reason	Year Of enactment	References
1	Government of India	Madras public health act, 1939	Advancing the Public Health of the (State)* of Madras	1939	Madras Public Health Act, 1939 http://www.sanchitha.ikm.in/sites/default/files/MadrasPublicHealth_%20Act1939.pdf last accessed on 24/07/2019
2.	Ministry of urban development-Government of India	Swath Bharat Mission Draft Model Municipal Solid Waste (Management & Handling), Cleanliness and Sanitation rules / bye-laws	Creating Public Nuisance	2016	Draft Model Municipal Solid Waste (Management & Handling), Cleanliness and Sanitation Rules / Bye-Laws Ministry Of Urban Development Government Of India http://164.100.228.143:8080/sbm/content/writereaddata/Draft%20Sanitation%20Byelaws.pdf updated on september 2016; last accessed on 24/07/2019
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5.	Rajasthan State Government	Rajasthan prevention of defacement of property act 2015	Public cleanliness	2015	The Rajasthan Prevention of Defacement of Property (Amendment) Act, 2015 http://lsg.urban.rajasthan.gov.in/content/dam/raj/udh/lsgs/lsg-jaipur/pdf/New%20Order%20PDF/109.pdf updated on 04/05/2015; last accessed on 24/07/2019
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		The West Bengal Prevention of Spitting in Public Place Act		2003	
11.	Nagalan d State Governm ent	The Nagaland Municipal Act, 2001	Cleanliness	2001	The Nagaland Municipal Act, 2001 https://www.nagaland.gov.in/Nagaland/UsefulLinks/The%20Nagaland%20Municipal%20

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16.	Bihar State				

	Governm ent				
	Madhya Pradesh State Governm ent	Madhya Pradesh Municipal Corporation Act 1956	Educate people about the importance of hygiene &keep public places clean	1956	The Madhya Pradesh Municipal Corporation Act, 1956;https://indiacode.nic.in/bitstream/123456789/3582/1/Municipal%20Corporation%20ACT1956.pdf; last accessed on 25/07/2019
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44	Chennai Metro railways	Offences listed under metro railways (operations and maintenanc e) act 2002		2002	The Metro Railways (Operation And Maintenance) Act, 2002 ; http://legislative.gov.in/sites/default/files/A2002-60.pdflast accessed on 26/07/2019
45	Delhi Metro Railways	offences listed under metro railways (operations and maintenanc e) act 2002		2002	
46	Jaipur metro rail corporati on	offences listed under metro railways (operations and maintenanc e) act 2002		2002	
47	Kochi metro rail Metro railways	offences listed under metro railways (operations and		2002	

		maintenance) act 2002			
48	Lucknow Metro railways	offences listed under metro railways (operations and maintenance) act 2002		2002	
49	Banglore Metro railways	offences listed under metro railways (operations and maintenance) act 2002		2002	
50	Hyderabad Metro Railways	Hyderabad metro rail rules		2017	Hyderabad Metro Rail; https://www.ltmetro.com/offences-penalties/last accessed on 26/07/2019
51	**I**ndian Railways	Indian Railways(Penalties for activities affecting cleanliness at Railway premises)Rules,2012		2012	Indian Railways; www.indianrailways.gov.in/railwayboard/view_section_new.jsp?lang=0&id=0...last accessed on 26/07/2019
52	East Coast Railways	Gazette Notification of November 26, 2012 and penalty provision INDIAN		2012	

		Railways Rule 2012.			
53	West Bengal Railways	The West Bengal Prohibition of Smoking and Spitting and Protection of Health of Non-smokers and Minors Act, 2001		2001	*West Bengal Prohibition of Smoking and Spitting and Protection of Health of Non-smokers and Minors Act, 2001;*https://wbxpress.com/west-bengal-prohibition-of-smoking-and-spitting-and-protection-of-health-of-non-smokers-and-minors-act-2001/last accessed on 26/07/2019

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ORIGINAL ARTICLE

Study of Co-relation between Clinical and Diagnostic Profile of Pediatric Tuberculosis in a Tertiary Care Hospital

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Abstract

Objective: Study of Co-relation between Clinical and Diagnostic profile of Pediatric Tuberculosis in a tertiary care hospital. **Methods**: This hospital-based observational study was conducted at the Department of Pediatrics, Muzaffarnagar Medical College and Hospital, covering a population of children aged <18 years diagnosed with TB. Data collection spanned 18 months, with a sample size of 100 children. **Results**: The study identified a predominant TB incidence in children aged 11-17 years (73%) with more females affected (66%) than males. Common symptoms included fever, cough, weight loss, and loss of appetite. Diagnostic findings showed a high use of Chest X-rays and Molecular tests. PTB was the most common form, accounting for 47 cases, EPTB accounting for 48 cases and Disseminated form was seen in 5 cases. **Conclusions:** Chest X-ray, Tuberculin Skin Test, Molecular Tests, and Blood Tests were universally performed on all patients. Microbiological confirmation is more common in pulmonary tuberculosis cases, while radiology, FNAC/Biopsy, and body fluid analysis are more utilized for extrapulmonary/disseminated cases. Diagnosing tuberculosis (TB) in children is often challenging due to several factors, including the difficulty in obtaining specimens and the typical paucibacillary nature.

Keywords: Tuberculosis, Pulmonary, Extra-Pulmonary, Children, Clinical, Diagnostic Tests

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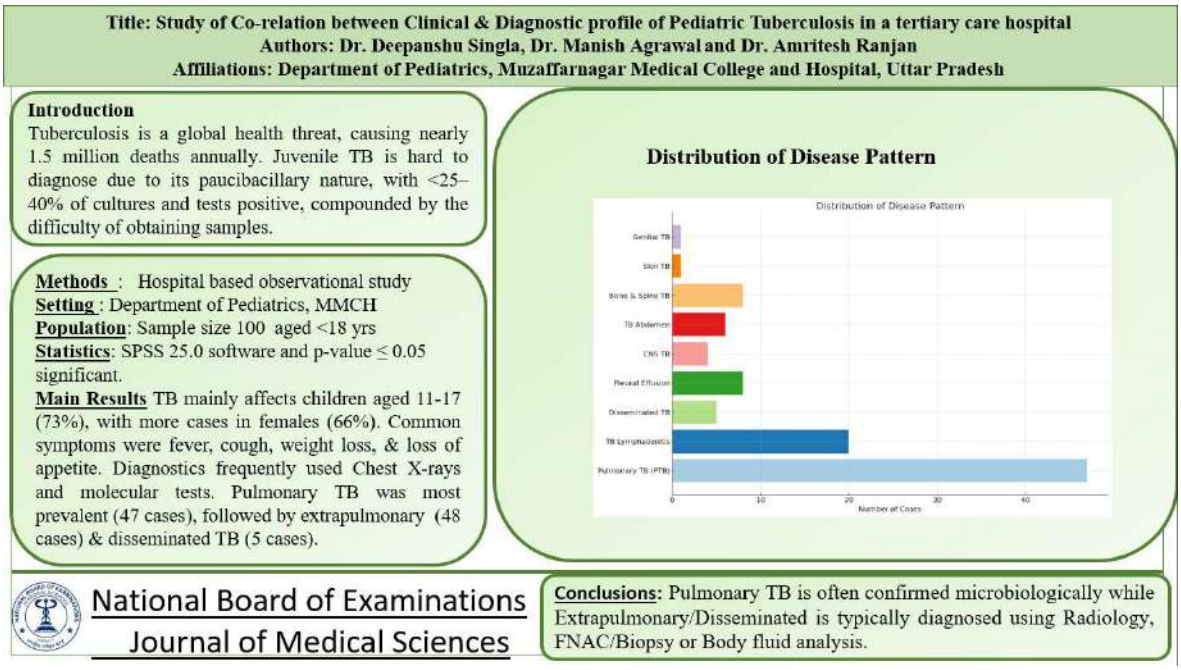
Graphical Abstract



Introduction

Tuberculosis stands as a formidable global health challenge, claiming the lives of nearly 1.5 million individuals each year [1]. The primary causative agent behind this deadly disease is Mycobacterium tuberculosis, although *M. africanum* and *M. bovis* also contribute to its occurrence to a lesser extent [2]. The incubation period spans between 1 to 6 months. Notably, children tend to manifest EPTB more frequently than PTB, often presenting with a disseminated form that surpasses the prevalence observed in adults [3].

It is anticipated that 3.42 lakh children aged 0-14 years in India contract tuberculosis (TB) annually, making up nearly 6% of all TB cases reported to the National Tuberculosis Epidemic Report (NTEP) in 2020 [4]. In 2020, almost one lakh TB affected children (0–14 years old) were reported to the NTEP, and an additional 1.4 lakh children in the 15–18 age range were reported to the NTEP [5]. The transmission is linked to the exposure of children to MTB from infected adults in their environment, making childhood TB a reflection of ongoing transmission and the effectiveness of control programs [6].

The diagnosis of childhood TB hinges on keeping a sharp suspicion level and conducting thorough clinical and laboratory evaluations [7]. The intricacies of pediatric TB diagnosis are exacerbated by the less specific clinical and radiological presentations in toddlers to adults, frequently leading to confusion with bacterial pneumonia. Microbiologic confirmation of juvenile TB infections is made more difficult by the paucibacillary character of the disease, with less than 25–40% of patients often showing positive results from TB cultures and the more recent fast molecular tests. Furthermore, acquiring sufficient specimens from young children presents logistical constraints that exacerbate the diagnostic difficulties [8].

Based on these factors, this study seeks to elucidate the unique characteristics of tuberculosis in children. Furthermore, it aims to offer a thorough examination of current and emerging methods for diagnosis, treatment, and prevention. By identifying critical gaps for future research, this review aims to support ongoing endeavors to combat and mitigate the public health challenges associated with pediatric TB.

Methods

This hospital based observational study was conducted in Department of Pediatrics, Muzaffarnagar Medical College and Hospital over a period of 18 months, from August 2022 to January 2024. The study was approved by the Institutional ethics committee.

All children diagnosed with Tuberculosis aged <18 years visiting MMC, Muzaffarnagar. Sample size was taken as 100 based on the prevalence of disease in the Hospital in Pre Covid 3 years. Inclusion criteria included Children with age group less than 18 years attending the OPD and IPD in our Hospital with the following symptoms: Fever for more than 2 weeks or Unexplained Fever, Cough more than 2 weeks, Loss of weight more than 5% within 3 months, swelling over the neck, seizures, or altered level of consciousness and confirmed by various diagnostic tests. Children belonging to age group for more than or equal to 18 years, children less than 18 years who are on ATT without supporting evidence of TB, children on ART, not giving consent for the study were excluded from the study.

Study Procedure included detailed history and examination of the child for age, gender, fever, cough, weight loss, hemoptysis, abdominal pain, abnormal body movements, pallor, lymphadenopathy, signs of meningeal irritation and raised ICT, respiratory Distress and various Diagnostic tests CBC, ESR, Tuberculin Skin Test, AFB Smear, Chest Xray, CBNAAT/ TRUNAAT were taken to find Co- Relation between Clinical Profile and Diagnostic Profile in Pediatric tuberculosis.

Statistical Analysis: Appropriate statistical significance test that was used for statistical analysis with SPSS 25.0 software. The P-value ≤ 0.05 was regarded as statistically significant.

Results

Pulmonary TB (PTB) is the most common form, accounting for 47 cases (47%). TB Lymphadenitis is the second most prevalent with 20 cases (20%). Other types include Pleural Effusion and Bone & Spine TB, each with 8 cases (8%), TB Abdomen with 6 cases (6%), Disseminated TB with 5 cases (5%), CNS TB with 4 cases (4%), and both Skin TB and Genital TB with 1 case each (1%) as shown in Figure 1.

In our study highest number of cases, 73 (73%), were seen in 11-17 years age group, followed by 6-10 years age group with 16 patients (16%), and the 0-5 years age group with 11 patients (11%) as shown in Table 1 and female to male ratio was 1.94:1.

Fever was reported by 83 patients (83%), loss of appetite by 75 patients (75%), and weight loss by 74 patients (74%). Cough is also prevalent, affecting 60 patients (60%). Other symptoms such as lymphadenopathy (21%), breathing difficulty (15%), and pallor (15%) are less common. Rarer symptoms include abdominal pain and nausea/vomiting (both 12%), joint pain and restriction of

movements (8%), chest pain (7%), neurological symptoms (5%), and hemoptysis (4%) as depicted in Figure 2.

The mean hemoglobin (Hb) level was 10.28 g/dL with a standard deviation of 1.64. The total leukocyte count (TLC) had a mean value of 9938.6 cells/mm³ with a standard deviation of 1696.9. The neutrophil count averaged 42.56% with a standard deviation of 9.2, while the lymphocyte count had a mean of 51.22% and a standard deviation of 11.6. The erythrocyte sedimentation rate (ESR) averaged 19.51 mm/hr with a standard deviation of 2.95. The tuberculin skin test (TST) was positive in 87% of the patients as shown in Table 2.

31 cases (65.9%) of PTB were microbiologically confirmed, compared to only 3 cases (5.6%) of EPTB/Disseminated. Radiology was helpful in diagnosing 16 PTB cases (34%) and 27 EPTB/Disseminated cases (50.9%). FNAC/Biopsy was used for EPTB/Disseminated, diagnosing 22 cases (41.5%). Body fluid analysis was also exclusively used for EPTB/Disseminated, diagnosing 16 cases (30.1%) seen in Table 3.

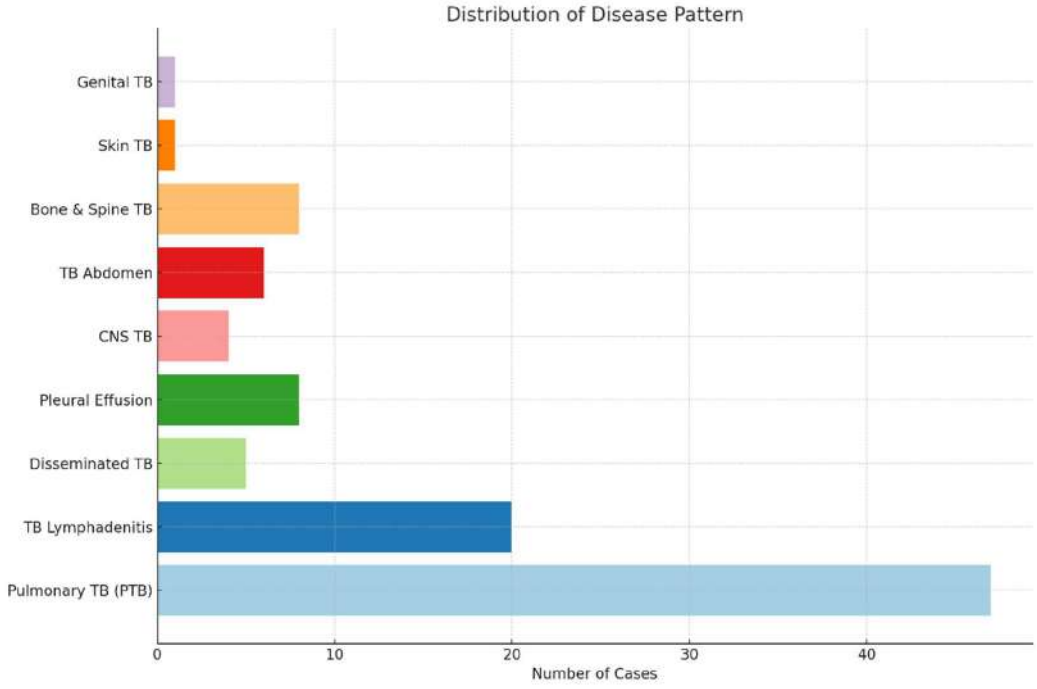


Figure 1. Distribution of Disease Pattern

Table 1. Age wise Distribution of Pediatric Tuberculosis Patients

Age Group (years)	**Number of Patients (%)**
0-5	11 (11%)
6-10	16 (16%)
11-17	73 (73%)

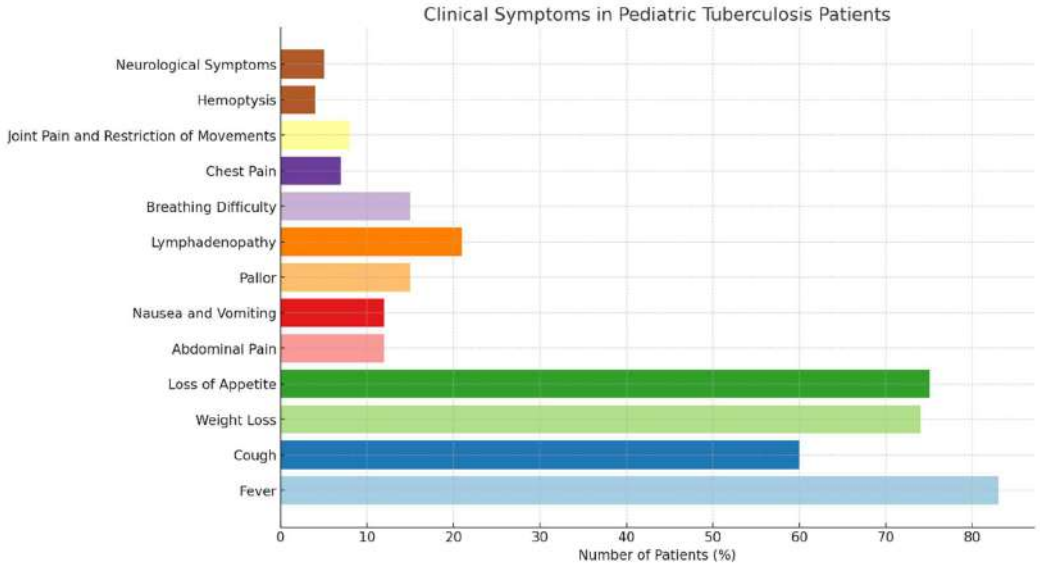


Figure 2. Clinical Symptoms in Pediatric Tuberculosis Patients

Table 2. Lab Investigations

Parameter	**Values**
Mean Hb(gm/dl)± SD	10.28 ±1.64
Mean TLC /mm^3 ± SD	9938.6 ± 1696.9
Mean Neutrophil (%)± SD	42.56 ± 9.2
Mean Lymphocyte (%)± SD	51.22 ± 11.6
Mean ESR(mm 1st Hour) ± SD	19.51 ± 2.95
TST(>10 mm)	87

Table 3. Investigation Procedures Helpful in Diagnosis

Investigation	PTB	%	EPTB/Disseminated	%	TOTAL
Microbiologically Confirmed	31	65.9%	3	5.6%	34
Clinically Diagnosed					
Radiology	16	34%	27	50.9%	43
FNAC/Biopsy	-		22	41.5%	22
Body Fluid Analysis	-		16	30.1%	16

Discussion

The age-wise distribution of pediatric tuberculosis patients demonstrated a clear prevalence in older children. Particularly, the age group of 11-17 years accounted for the highest proportion, with 73% of the cases, equivalent to 73 patients. This can be because of greater exposure to infectious agents in school settings or community environments in contrast to younger children who tend to spend more time at home. The ratio of male to female was 1:1.9. This gender difference could potentially be influenced by gender inequality that still exists in many social aspects including health care. This could be attributed to parents delaying medical attention and opting to bring their daughters to tertiary care Center only when they are severely ill. This is also seen in other studies such as one conducted by Singh et al. (2021) [9] where male: female ratio was 1:2.8.

Among the clinical symptoms fever was the most prevalent symptom, affecting 83% of the patients. Similarly, substantial percentages of the study reported loss of appetite (75%) and weight loss (74%) and Cough in 60% of Patients. Other symptoms included lymphadenopathy in 21% of the patients, which is indicative of an immune response to infection, and breathing difficulties in 15% of the cases, underscoring the respiratory compromise that tuberculosis can cause. A Research conducted by Sreeramareddy et al. (2010) [10] identified fever, cough, and lymph node swelling as the predominant presenting complaints among patients. Similarly, findings from a study by Loh et al. (2018) [11] reiterated the prevalence of fever, cough, and weight loss as common presenting symptoms.

Moreover, Laghari et al. (2019) [12] observed cough and weight loss as primary symptoms, with fever following closely. Additionally, a study conducted by Shrestha et al. (2011) [13] aimed at interpreting the clinical profile of Tuberculosis (TB) in children highlighted fever (75.6%), cough (63.4%), and weight loss (41.5%) as the most frequently encountered clinical manifestations.

Out of 100 patients evaluated, 32 (32%) reported having a history of contact with tuberculosis, suggesting that they were exposed to active TB cases in their environment. On the other hand, a larger group consisting of 68 patients (68%) had no such contact history.

A study conducted by Nandarvawala et al. 2023 [14], where known contact of TB cases was reported in 20.9% patients.

In our study, the distribution of tuberculosis types—Pulmonary Tuberculosis (47%), Extrapulmonary Tuberculosis (48%), and Disseminated Tuberculosis (5%)—across various age groups revealed that older children and adolescents (11-17 years) presented with the highest incidence of both PTB and EPTB, recording 37 and 35 cases respectively. Nandarvawala et al. [14] conducted a study in 2023 and reported that 32.7% had pulmonary TB, 50% had extrapulmonary TB, and the most prevalent kind of extrapulmonary TB was TB lymphadenopathy, and 17.27% of cases had disseminated illness. Mazta et al. (2012) [15] reported PTB in 55% of cases, with the remaining 45% diagnosed with EPTB.

Median Hb levels were slightly low and TST was positive in 87% of the patients as seen in other study by Singh et al. (2021) [9]

Chest X-ray findings were abnormal in 59% of patients. Significant findings included hilar lymphadenopathy in 30% of patients and Consolidation in 16%, with less common manifestations such as pleural effusion, cavitation and miliary patterns observed in 9%, 2% and 2% of the cases, respectively.

Microbiological confirmation is gold standard for the diagnosing TB. Microbiological confirmation is not always possible due to the paucibacillary nature of pediatric TB and difficulty to obtain sample. However, microbiological confirmation by CBNAAT/TRUNAAT was achieved in 65.9% of PTB cases and 60% of cases with Disseminated TB whereas none of the EPTB cases were confirmed by Microbiology. A similar microbiological confirmation was reported by another study. [16]

The study's strength is that it is one of the few studies from India that studied the co-relation between clinical and diagnostic profile of Pediatric TB. The limitations of the study were that the data was collected from a single hospital, which may limit the generalizability of the findings to other regions or populations and the study depends heavily on the accuracy of clinical diagnoses and the completeness of medical records, which may vary and impact the reliability of the data collected.

Conclusion

Majority of pediatric tuberculosis patients (73%) fall within the age group of 11-17 years, with fewer cases in younger age groups. Fever, Cough, loss of appetite, and weight loss are the most common symptoms among patients, occurring in over 70% of cases. A significant proportion of patients (68%) have no history of contact with tuberculosis. Lower socio-economic status is associated with a higher prevalence of underweight patients.

Lab investigations show mean hemoglobin levels of 10.28 g/dL and positive Tuberculin Skin Test results in 87% of patients. Microbiological confirmation is more common in pulmonary tuberculosis cases, while radiology, FNAC/Biopsy, and body fluid analysis are more utilized for extrapulmonary/disseminated cases.

Conflict of Interest

The authors declare no conflicts of interest.

Ethical Approval

The study was approved by the Institutional ethics committee.

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ORIGINAL ARTICLE

Community Perception on Rabies Prevention and Control Among the General Population in Puducherry: A Cross-Sectional Study

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Abstract

Introduction: Rabies, a deadly viral disease transmitted through animal bites, poses a significant public health challenge in many regions, including Puducherry. Effective prevention and control rely heavily on community awareness and perception. Understanding how the general population perceives rabies risk and prevention strategies is crucial for developing targeted public health interventions. **Objectives:** To describe the socio-demographic profile and to assess community perceptions of rabies prevention and control among the general population in Puducherry. **Methods:** A community-based cross-sectional study, conducted in the rural and urban Puducherry region from October 2023 to December 2023. A total of 200 individuals were chosen from rural and urban Puducherry regions using a systematic random sampling technique. Individuals over 18 years of age residing in both rural and urban areas of Puducherry were included in the study. Semi-structured questionnaire was used to collect the data and entered in MS Excel 2019. Chi-square test was applied to test the difference in knowledge between urban and rural. **Results:** The majority of the study participants belonged to the age group of 18-29 years (55%), 152 were males and 48 were females. Most of the participants (99%) heard about Rabies and their source of knowledge about Rabies was from Doctors (40.5%), Newspapers & Media (39.5%), and Friends (19.0%). Approximately 82.5% of participants were aware of how rabies is transmitted, while 78.5% understood the signs of the disease. **Conclusion:** Education plays a significant role in the awareness of rabies as most participants were educated at least up to the primary level in the current study. According to our findings, clear gaps exist in rural people's understanding and attitudes toward rabies prevention and control.

Keywords: Community Perception, Rabies Prevention and Control, General population

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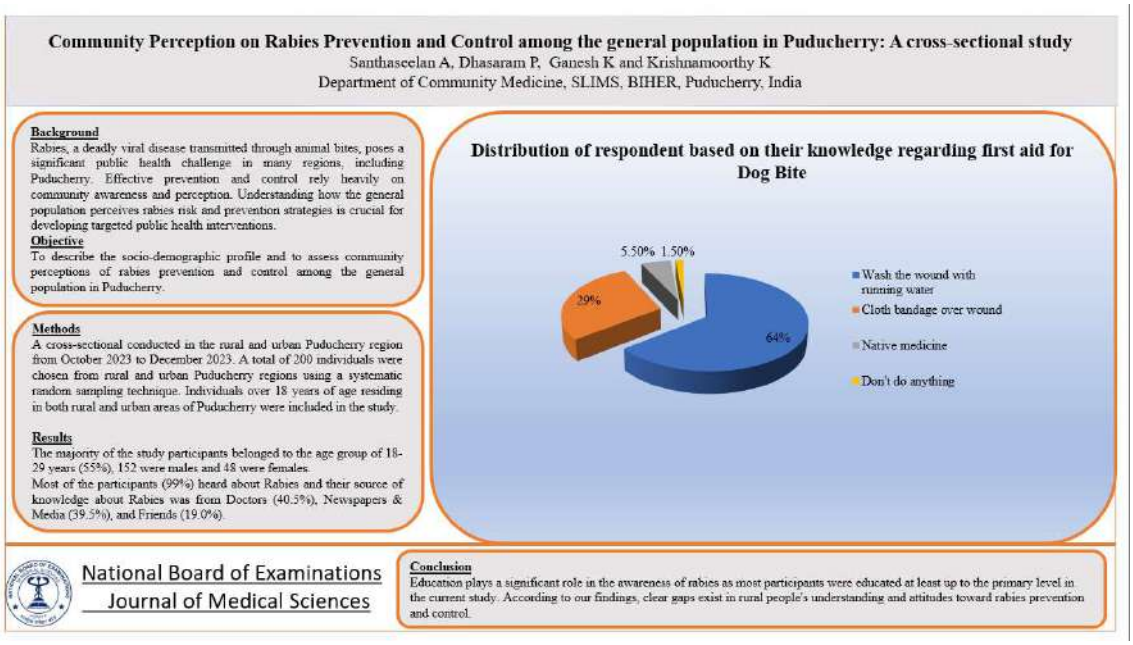
Graphical Abstract



Introduction

Rabies is a viral, zoonotic disease that can be prevented with vaccination but remains fatal once clinical symptoms appear. Domestic dogs are the primary source of rabies transmission to humans, responsible for up to 99% of cases. In regions where rabies is endemic, such as parts of Asia and Africa, 30% to 60% of dog bite victims are children under 15 years [1].

Annually, rabies claims the lives of around 55,000 people worldwide, with the majority of deaths occurring in Asia and Africa. The South-East Asian Region (SEAR) alone accounts for 60% of these fatalities. India, a part of SEAR, experiences a significant burden from rabies, reporting approximately 130-210 deaths from rabies each year and 6-7 million animal bites annually [2]. Efforts to eradicate rabies are hindered by challenges such as inadequate coordination, limited data on dog populations, and insufficient funding for vaccination campaigns. Global health organizations have called for intensified efforts to eliminate 'Dog-Mediated Rabies' by 2030, aiming for "Zero by Thirty" [3].

In India, where rabies is widespread, animal bites present a major public health issue with an estimated 17.4 million bites occurring each year, translating to an incidence rate of 1.7%. Nearly 20,000 deaths annually in India are attributed to rabies, making each animal bite a potential rabies case [4]. A significant obstacle in combating rabies is the lack of community awareness, emphasizing the need for community engagement as a crucial element in any successful public health initiative [5].

Simple preventive measures, like washing bite wounds with soap and water, can make a significant difference in reducing the number of rabies fatalities in at-risk human populations. Awareness and education of the public about the epidemiological features of rabies, as well as simple preventive measures will help to prevent and control rabies in India. The objective of the study was to describe the socio-demographic profile of the study

participants and to assess community perceptions of rabies prevention and control.

Materials and Methods

The present study was a community-based cross-sectional study, conducted in the rural and urban Puducherry region. The urban field practice and rural field practice area of our medical college was chosen as the study setting. A total of 200 individuals were chosen from both the regions of Puducherry using a proportionate to size stratified random sampling. Proportionate to size was based on the population distribution of the two regions (urban and rural). Within the strata that is urban and rural areas the participants was selected by simple random sampling from the enumeration list of family folder. The study was conducted from October-December 2023. The sample size was estimated using Cochran's formula $n= Z^2pq/ d^2$ in which the prevalence of awareness of rabies was 68.7% based on the previous study [6] and d = 10% of p, the total sample size calculated was 182, with the addition of 10% non-response rate, the final sample size arrived to be 200. A systematic random sampling was used to select the study participants for the survey. Individuals over 18 years of age residing in both rural and urban areas of Puducherry were included in the study. The following subjects were excluded: 1) those who were less than 18 years of age and 2) those who had a mental illness that would prevent them from completing questionnaires. Written informed consent was obtained from all the study participants in the survey. A pre-designed, semi-structured questionnaire was used for interviewing the study participants in the survey. The following information obtained includes socio-demographic profile and questions for assessing the knowledge and awareness about rabies prevention and control. The data was entered in MS EXCEL 2019 and analyzed using SPSS Statistics 16.0. Quantitative variables were expressed in mean standard deviation and qualitative variables were expressed in proportions. The differences between proportions were analyzed using the Chi-Square test.

Results

The present study was carried out among 200 participants in the urban and rural Puducherry region. The majority of the study participants belonged to the age group of 18-29 years (55%), 152 were males and 48 were females. The current study found that 39% of them were graduates and above the level of education and 29% of them were employees. Location-wise, 64% of them belonged to the Urban and 36% belonged to the rural region (Table 1). Majority of the study participants (99%) heard about Rabies and their source of knowledge about Rabies was from Doctors (40.5%), Newspapers & Media (39.5%), and Friends (19.0%). Approximately 82.5% of participants were aware of how rabies is transmitted, while 78.5% understood the signs of the disease. Knowledge about the risk of death associated with rabies was held by 73.5% of participants, 66% were informed about the severity of the disease depending on the location of the bite, and 79% were aware of the existence of the anti-rabies vaccine (Table 2).

Table 1. Distribution of study participants based on socio-demographic characteristics (n=200)

Variable		Frequency (n)	Percentage (%)
Age	18-29	110	55
	30-59	80	40
	≥60	10	5
Gender	Male	152	76
	Female	48	24
Educational Level	Illiterate	22	11
	High school	46	23
	Diploma	54	27
	Graduate/ above	78	39
Occupation	Student	18	9
	Farmer	24	12
	Employee	50	29
	Business	44	22
	Dependent/ Housewife	52	26.0
Place of residence	Urban	128	64.0
	Rural	72	36.0

Based on their knowledge of First aid for rabies, 64.0% of participants wash their wounds with running water, 29% apply cloth bandages on the wound, and 5.5% of participants will go for native medicine (Figure 1). Regarding the vaccination status of pet dogs, 51% of participants vaccinated their pets within one year, 38% were vaccinated for more than a year, and 11.0% never vaccinated their pets.

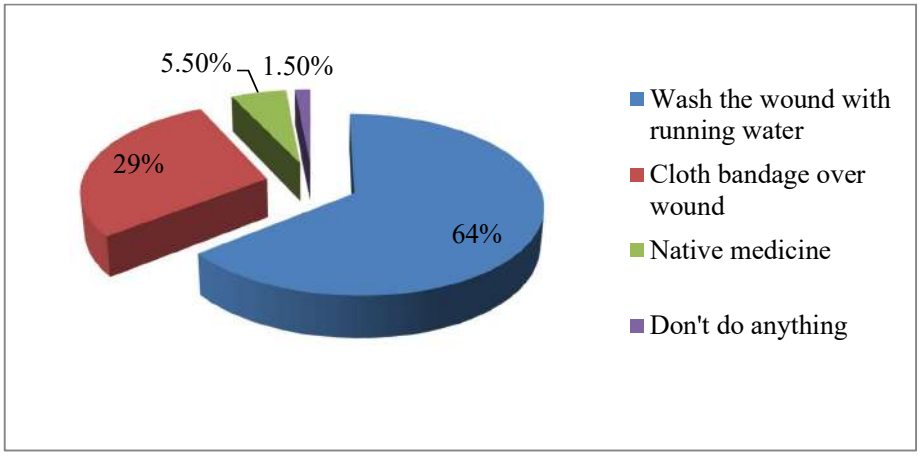


Figure 1. Distribution of respondent based on their knowledge regarding first aid for Dog Bite

Table 2. Respondent knowledge of the prevention of Rabies (n=200)

Variables		**Frequency (n)**	**Percentage (%)**
Heard about Rabies	Yes	198	99.0
	No	2	1.0
Source of Knowledge	Doctor	81	40.5
	Newspaper & Media	79	39.5
	Friends	38	19.0
	Don't know	2	1.0
Mode of Transmission	Know	165	82.5
	Don't Know	35	17.5
Sign of identification	Know	157	78.5
	Don't know	43	21.5
Risk of death	Know	147	73.5
	Don't know	53	26.5
Severity based on site of bite	Know	132	66.0
	Don't know	68	34.0
Knowledge on ARV	Know	158	79.0
	Don't know	42	21.0

It was found that awareness of the Mode of transmission of rabies, signs of identification, Severity based on the site of the bite, and knowledge of ARV were more in the urban region when compared to the rural region. The differences were also found to be statistically significant (P<0.001) (Table 3).

Table 3. Respondent knowledge of the prevention of Rabies (n=200)

Variables		**Urban**	**Rural**	**P value**
Mode of Transmission	Know	120 (93.7)	45 (62.5)	<0.001
	Don't Know	8 (6.3)	27 (37.5)	
Sign of identification	Know	116 (90.6)	41 (56.9)	<0.001
	Don't know	12 (9.4)	31 (43.1)	
Risk of death	Know	109 (85.2)	38 (52.8)	<0.001
	Don't know	19 (14.8)	34 (47.2)	

Severity based on site of bite	Know	99 (77.3)	33 (45.8)	<0.001
	Don't know	29 (22.7)	39 (54.2)	
Knowledge on ARV	Know	118 (89.4)	42 (58.3)	<0.001
	Don't know	14 (10.6)	30 (41.7)	

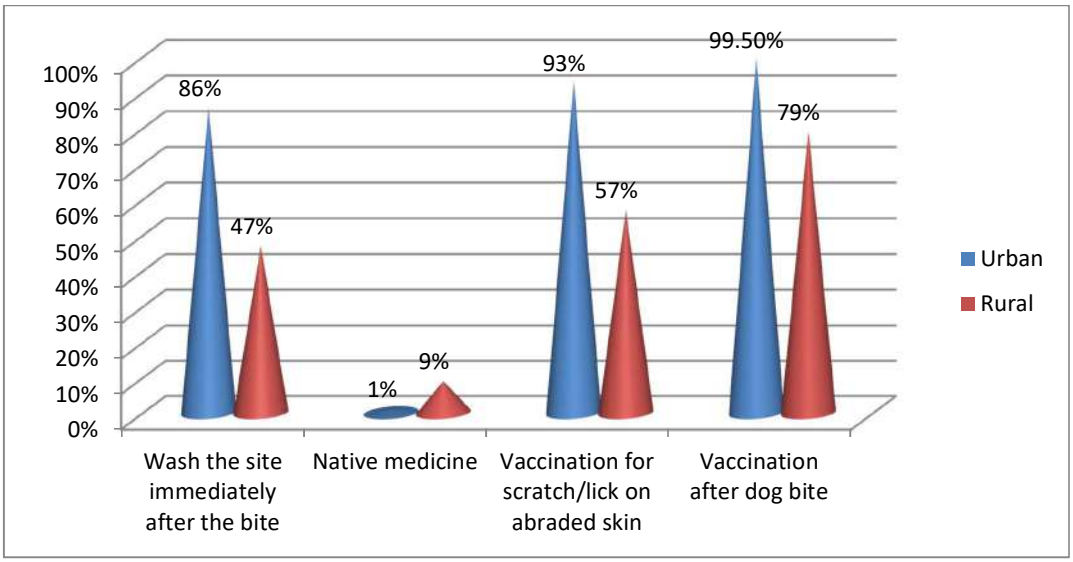


Figure 2. Distribution of the respondent on dog bite management

Discussion

The present study was done to assess community perceptions of rabies prevention and control among the general population of the Puducherry region. Community awareness and Knowledge of rabies are very important for its prevention and control. Globally, studies on awareness of rabies have been extensively conducted to gain insight into the disease and its preventive strategies.

In the present study, the percentage of participants who had heard about rabies was 198 (99.0%) similar to the study done in Avadi-Tiruvallur district, Tamilnadu [7] (98.6%). The results were higher compared to other studies which ranged from 60.0% to 80.0% [8,9]. In this study, the study participants reported that the major source of information about rabies was Doctors (40.5%) followed by Newspapers & Media (39.5%), similar to the study done by Ghosh et al. [12] and Vijayalakshmi et al. [7].

In the present study, the majority of the study participants reported 82.5% knew about the mode of transmission of rabies which is similar to the study by Vijayalakshmi et al. [7] and Herbert et al. [10]. Regarding the sign of identification, the current study reported that 78.5% of participants known about the sign of identification of rabies which is similar to the study by Sivagurunathan et al. [11] (78.6%).

In the present study, the maximum number of participants (73.5%) were known about the risk of death due to rabies, similar to the study by Krishnamoorthy et

al. [12] (74.8%) and Vijayalakshmi et al. [7] (83.7%) but in contrast, the study by Herbert et al. [10] reported only (54.0%) and Herbert et al. [10] (54.1%). Regarding the knowledge of ARV, the current study reported that 79.0% of participants knew about ARV which is similar to the study done by Vijayalakshmi et al. [7] (87.0%).

In the current study, the knowledge regarding First aid reported that 64.0% of participants wash the wound with running water followed by 29.0% of participants with cloth bandage over the wound which is similar to the study done by Muthunuwan et al. [13] in Srilanka shows 90.5% of the participants knew washing the bite wound was an important first aid measure and Vijayalakshmi et al. [7] study reported that 65.8% of subjects wash the wound with water. In contrast, Laishram et al. [14] study observed that 73.8% of participants wash the wound with antiseptics and only 0.6% of them washed with water.

Regarding the vaccination status of pet dogs, the majority of the participants (51.0%) vaccinated their pets within one year followed by 38.0% who were vaccinated for more than a year and 11.0% who never vaccinated their pet dogs in the current study. In similar, a study done by Herbert et al. [10] observed that 58.6% of participants were vaccinated their pet dogs and 43.2% did not vaccinate their pets.

The main limitation of our study was generalizability to other regions as the literacy rate may differ from our study setting to other geographical areas.

Conclusion

In this study, most participants were familiar with rabies, including its transmission methods, identifying symptoms, the risk of death, and knowledge about Anti-Rabies Vaccines (ARV). Education significantly influences rabies awareness, as the majority of participants in the study had at least primary education. However, our findings reveal noticeable gaps in the understanding and attitudes of rural communities regarding rabies prevention and control. The rural population lacks sufficient measures for managing rabies on their own. Therefore, implementing community-based health education is crucial in these areas to improve awareness and promote effective rabies prevention and control.

Statements and Declarations

Conflicts of interest

The authors declares that they do not have conflict of interest.

Funding

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ORIGINAL ARTICLE

Comparison of Effectiveness of Teaching Steps of Abdominal Palpation Using Manikin vs Video Demonstration for First Clinical Year Students

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Abstract

Introduction: Acquiring fundamental procedural skills is crucial for medical graduates to ensure patient safety. Traditional teaching methods may compromise safety, leading to the rise of Simulation-based Medical Education (SBME) and video-based instructional approaches. This study compares the effectiveness of manikin-based and video-based training for abdominal palpation techniques among second-year MBBS students. **Objectives:** The primary objective is to compare the proficiency of students undergoing manikin-based (Group A) and video-based (Group B) training in abdominal palpation techniques. Secondary objectives include assessing specific skill aspects, understanding student perceptions, and exploring gender differences. Methods: A comparative study was conducted among 146 second-year MBBS students, randomly assigned to Group A (manikin skill training) or Group B (video-based skill training). A structured questionnaire with 15 questions assessed skill proficiency. Data were analyzed using SPSS 27, with descriptive statistics, Student's t-test, and subgroup analyses for gender differences. **Results:** High proficiency (>93%) was observed in both groups. Group A had a statistically higher overall score than Group B (14.2 ± 0.69 vs. 13.83 ± 0.98, $P<0.05$). Group A also showed significant advantages in posture and hand position (43.2% vs. 28.2%), superficial palpation (100% vs. 94.4%), and spleen palpation (100% vs. 93%). No significant gender differences were noted within the groups. **Conclusion:** Manikin-based training is superior to video-based training for abdominal palpation techniques, emphasizing the importance of active engagement and hands-on practice in medical education.

Keywords: Simulation based training, video-based training, abdominal palpation, medical education, procedural skills

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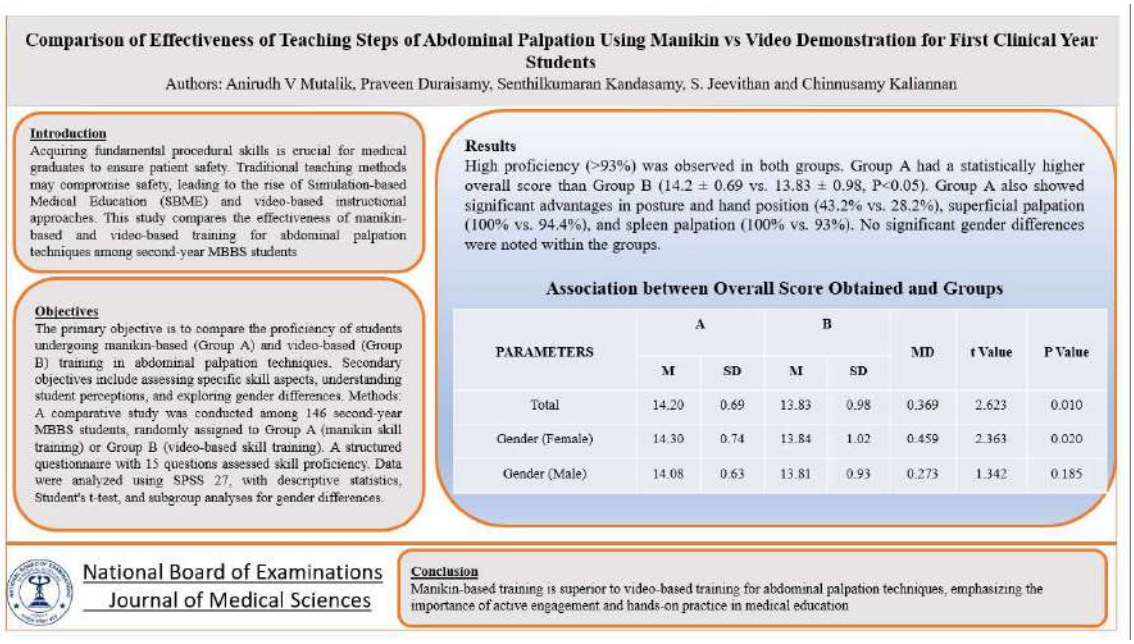
Graphical Abstract



Introduction

Acquiring fundamental procedural skills stands as a crucial competency for medical graduates to ensure patient safety [1]. Traditionally, these skills were imparted through observation of experienced practitioners at the bedside, followed by independent execution on actual human patients [2]. However, this traditional approach raises concerns about compromising patient safety due to potential medication errors. To address these issues, Simulation-based Medical Education (SBME) has emerged as a viable solution [3].

The use of video-based instructional methods presents distinct advantages, particularly in teaching large groups with consistency and authenticity [4]. Studies indicate that video-based education enhances students' ability to learn and replicate clinical skills effectively [5]. This is attributed to the simultaneous processing of auditory and visual information, promoting active learning experiences, increased concentration, and motivation. Structured clinical skill demonstrations through video not only facilitate the acquisition of specific skills and knowledge but also ins till the essential attitudes required for patient care [6-9].

Simulation, defined as a training and feedback method involving practice in lifelike circumstances, has gained prominence in medical education. Initially pioneered in industries such as aviation and aerospace, simulation techniques have found widespread usage in emergency care, anesthesia, and various clinical settings [10]. The adoption of simulation in standardized clinical training creates a safe learning environment where students can engage in repeated learning and retraining without the fear of causing harm to real patients [3,11,12].

Despite significant investments in simulation labs to replicate real clinical settings, the integration of human-like manikins has become common. These advanced manikins offer realistic features to enhance the learning experience. The primary rationale behind using manikins is

to allow students to practice and refine their skills and competencies without posing any risk to human patients.[13]

The effectiveness of simulation in health professionals' education is well-supported by numerous studies, validating its inclusion as a valuable component in training programs. But there are a very few studies that compares the effectiveness between video demonstrations and manikin demonstrations. This study has been aimed to compare the effectiveness of simulation training imparted by video demonstrations with manikin demonstrations.

Materials and Methods

This comparative study, conducted by the Department of General Medicine, involved 146 second-year MBBS students from a tertiary care medical college. The study, conducted between January and July 2022, received ethical committee clearance (01/IHEC/2022), and informed consent was obtained from all participating students.

The participants were divided into two groups: Group A, comprising 75 students exposed to manikin skill training, and Group B, consisting of 71 students who underwent video-based skill training for abdominal palpation techniques. Before the commencement of the study, all students received a comprehensive briefing on abdominal palpation, including its necessity, applications, and implications. Subsequently, the students were randomly assigned to either Group A or B.

To assess their proficiency, a structured questionnaire consisting of 15 questions covering essential steps in abdominal palpation was developed. Each correct step was awarded one mark, partially correct responses received 0.5 marks, and incorrect responses received zero marks. The collected data were entered into Microsoft Excel and analyzed using SPSS 27. Descriptive statistics, including frequency and percentages, along with mean ± standard deviation, were employed. The difference between the two groups was measured using the Student's t-test. Additionally, an analysis of the score differences between male and female students was conducted separately. A significance level of $P<0.05$ was considered statistically significant.

Results

In both groups, a high percentage (>93%: n=136) of participants demonstrated proficiency in various aspects, including self-introduction, hand hygiene before the procedure, positioning the patient correctly, assuming the correct stance, explaining the procedure, deep palpation, liver palpation, inguinal orifice and lymph node palpation. Additionally, approximately 84.2% (n=123) observed the patient's face during the procedure. No statistically significant differences were found between Group A and Group B in these parameters.

In terms of posture and hand placement of the students, 43.2% (63) of the study population excelled. Among them, 57.3% (43) belonged to Group A, while 28.2% (20) were from Group B. A notable 97.3% (142) of students performed superficial palpation correctly, with 100% (75) accuracy in Group A and 94.4% (67) in Group B. For spleen palpation, 96.6% (141) performed correctly overall, with all participants (75) in Group A and 93% (66) in Group B. A statistically significant difference between the two groups was observed in these specific parameters (Table 1).

Table 1. Distribution of Marks obtained According To OSCE Check List

	Over all						**Group A**						**Group B**					
	0		**0.5**		**1**		**0**		**0.5**		**1**		**0**		**0.5**		**1**	
Introduce self	0	0.0	2	1.1	144	98.6	0	0.0	2	2.7	7.3	97.3	0	0.0	0	0.0	75	100.0
Wash hands	0	0.0	1	0.7	145	99.3	0	0.0	1	1.3	74	98.7	0	0.0	0	0.0	75	100.0
Patient in right position	0	0.0	2	1.4	144	98.6	0	0.0	2	2.7	73	97.3	0	0.0	0	0.0	75	100.0
Student in right position	0	0.0	1	0.7	145	99.3	0	0.0	0	0.0	75	100.0	0	0.0	1	1.4	74	98.6
Explaining the procedure to patient	0	0.0	4	2.7	142	97.3	0	0.0	4	5.3	71	94.7	0	0.0	0	0.0	75	100.0
Posture and hand placement of the student	1	0.7	82	56.2	63	43.2	1	1.3	31	41.3	43	57.3	0	0.0	51	71.8	20	28.2
Superficial palpation	0	0.0	4	2.7	142	97.3	0	0.0	0	0.0	75	100.0	0	0.0	4	5.6	67	94.4
Deep palpation	0	0.0	3	2.1	143	97.9	0	0.0	0	0.0	75	100.0	0	0.0	3	4.2	68	95.8
Observe patient face	0	0.0	23	15.8	123	84.2	0	0.0	10	13.3	65	86.7	0	0.0	13	18.3	58	81.7

Liver palpation	0	0.0	2	1.4	144	98.6	0	0.0	0	0.0	75	100.0	0	0.0	2	2.8	69	97.2
Spleen palpation	0	0.0	5	3.4	141	96.6	0	0.0	0	0.0	75	100.0	0	0.0	5	7.0	66	93.0
Renal palpation	0	0.0	40	27.4	106	72.6	0	0.0	16	21.3	59	78.7	0	0.0	24	33.8	47	66.2
Gallbladder palpation	0	0.0	100	68.5	46	31.5	0	0.0	49	65.3	26	34.7	0	0.0	51	71.8	20	28.2
Inguinal orfice palpation	0	0.0	5	3.4	141	96.6	0	0.0	0	0.0	75	100.0	0	0.0	5	7.0	66	93.0
Inguinal lympnode palpation	0	0.0	10	6.8	136	93.2	0	0.0	3	4.0	72	96.0	0	0.0	7	9.9	64	90.1

Table 2. Association between Overall Score Obtained and Groups

PARAMETERS	**A**		**B**		**MD**	**t Value**	**P Value**
	M	**SD**	**M**	**SD**			
Total	14.20	0.69	13.83	0.98	0.369	2.623	0.010
Gender (Female)	14.30	0.74	13.84	1.02	0.459	2.363	0.020
Gender (Male)	14.08	0.63	13.81	0.93	0.273	1.342	0.185

When comparing the overall scores of Groups A and B, a statistically significant difference emerged (14.2 ± 0.69 in Group A vs 13.83 ± 0.98 in Group B). Further analysis based on gender revealed a significant difference between procedures for females (13.24 vs 13.84), while no difference was observed among males (14.08 vs 13.81) (Table 2).

Discussion

This cross sectional study was conducted to understand the effectiveness of manikin teaching on video based skill teaching. Students were able to impart better skill and knowledge using simulated techniques compared to traditional methods of teaching [9,10,13]. There was a slight significant high score in manikin teaching compared to video based teaching. Similar result was observed in a study done by Adiyeninka et al. [14].

The results of the study indicate that there was a statistically significant difference between the two groups, favouring manikin-based skill training (Group A) over video-based training (Group B). The argument that manikin training is superior may stem from the active involvement of students in performing procedures rather than merely observing them in a video.

The Peyton Four-Step Approach, which includes Demonstration, Deconstruction, Comprehension, and Performance, is a relevant framework to consider in this context. In Group A (manikin training), students likely experienced a comprehensive Peyton approach. They were first demonstrated the procedure using the manikin, followed by a step-by-step breakdown (deconstruction) of the skill, ensuring a deep understanding (comprehension). Finally, students actively performed the procedure on the manikin, achieving the final step of the Peyton approach (performance).

On the other hand, in Group B (video training), students might have had limited opportunities to actively engage with the procedure. While video-based education offers the advantage of simultaneous auditory and visual processing, it may lack the hands-on, experiential learning component that is crucial in developing procedural skills. The Peyton approach emphasizes the importance of active participation and hands-on practice for effective skill acquisition [9,11-15].

The statistically significant difference in overall scores between the two groups suggests that the manikin-based training approach had a more positive impact on students' performance in abdominal palpation techniques. The tactile feedback, realistic simulation, and active participation offered by manikin training likely contributed to a better understanding and execution of the skills compared to video-based training.

Conclusion

The findings support the notion that manikin-based skill training is more effective than video-based training in this context. The Peyton Four-Step Approach aligns with this observation, emphasizing the importance of active engagement and hands-on practice in the learning process. Incorporating manikin-based training methodologies in medical education can enhance procedural skills, ensuring that students are not merely passive observers but active participants in their learning journey.

Statements and Declarations

Conflicts of interest

The authors declares that they do not have conflict of interest.

Funding

No funding was received for conducting this study.

Ethical Approval

Ethical approval from ethical committee clearance (01/IHEC/2022)

Informed Consent

Informed consent was obtained from all participating students.

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ORIGINAL ARTICLE

A Cross Sectional Study on the Expression of MIB-1 and P16INK4a in Oral Carcinoma in a Tertiary Care Hospital

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Abstract

Background: Oral cancer is one of most prevalent cancer with high morbidity and mortality rate in India. Around 90% are squamous cell carcinomas among the oral cancers. Uncontrolled proliferation of cell is considered to be the key processes of oncogenesis. MIB-1 or Ki67 is expressed in all proliferating cells and used as a tool for estimating the percentage of dividing cells within a tumor. In addition to it, MIB-1 acts as a potentially prognostic marker in oral malignancies. **Materials and Methods:** Around 100 cases of oral squamous cell carcinoma were assessed for nuclear atypia, mitotic activity and necrosis. For Ki-67, strong nuclear positivity was seen as favorable. There were three grades: 1 for 10–30%, 2 for 30–50%, and 3 for 50% and above. The number of positive cells and staining intensity for p16 (nuclear or/and cytoplasmic staining) were computed. **Results:** Ki-67 and p16 expressions were seen in oral squamous cell carcinomas that are well, moderately, and poorly differentiated. Ki-67 expression increased when grades rose from well differentiated to poorly differentiated carcinoma. p16 had a better expression in well differentiated carcinoma compared to poorly differentiated carcinoma. The mean mitotic count, were increased in high grade neoplasms. **Conclusions:** Therefore, the expression of p16 and Ki-67 in malignant lesions of the oral squamous cell carcinoma can be used in conjunction with the histomorphological attributes to research their capacity for proliferation of oral malignancies.

Keywords: Head and neck, Human papilloma virus, MIB-1 antigen, p16INK4A gene, Squamous cell carcinoma

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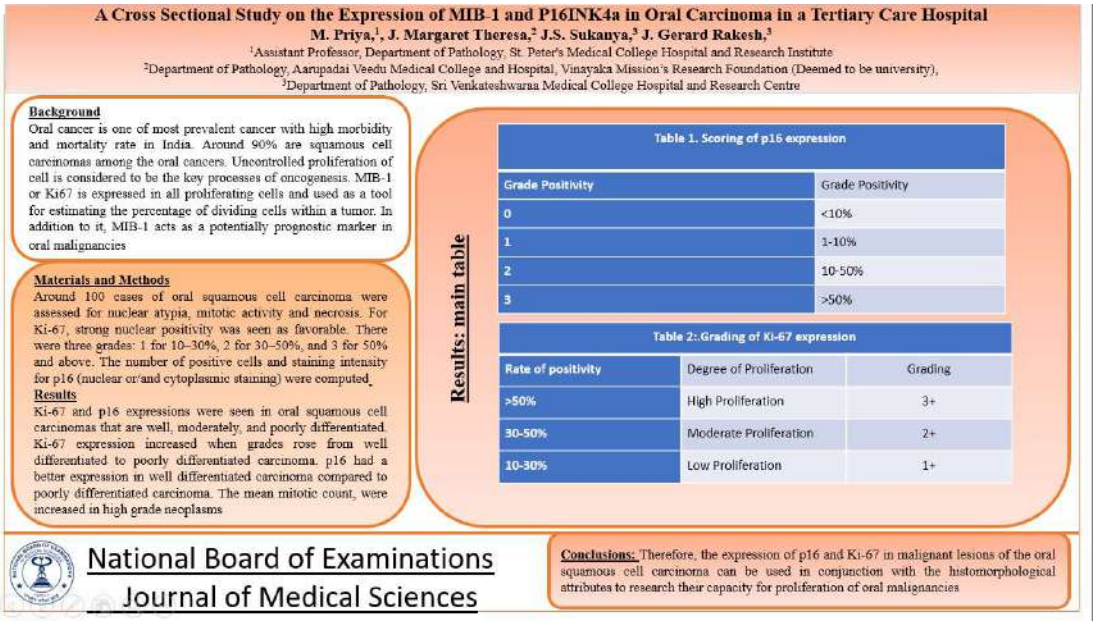
Graphical Abstract



Introduction

Squamous cells carcinoma of oral cavity is the most frequent type of head and neck neoplasm. Annually more than 500,000 new cases of squamous cell carcinoma of oral cavity reported worldwide [1]. Incidence of oral cancer in gradually increasing every year and being a major health problem in India [2]. Oral and oropharyngeal cancers is the 6th most common cancer. Most common histological type of oral and oropharyngeal cancer is squamous cell carcinoma accounting around 90% among the neoplasm [3]. Various studied have proved that squamous cell carcinoma of oral cavity is associated with human papillomavirus (HPV). Squamous cell carcinoma associated with HPV believed to have better prognosis. They exhibit a distinct tumor morphology, with different demographics and unique characteristic and molecular profiling [4]. Various methods are available to detect the HPV, but the single best method to diagnose HPV remains controversial. In recent days highly preferred and recommend method to identify HPV in biopsy is In Situ Hybridization (ISH) and p16 immunohistochemistry in combination for detecting high-risk HPV.

p16 is a protein that suppress tumor and is a cyclin-dependent kinase inhibitor. p16 is usually mutated or deleted in squamous cell carcinoma. p16 overexpression is observed in tumors with biologically active HPV. HPV E7 protein functionally inactivates the retinoblastoma protein (Rb). Human papilloma virus driven malignancies are identified with a strong and diffuse pattern of p16 immunostaining and is thought to be an extremely sensitive diagnostic marker [4]. However p16 overexpression can also result from other mechanisms [4-6]. Tumorogenesis is a abnormal cell proliferation; the expression of the Ki-67 protein is strongly correlated with cell proliferation and may serve as a biomarker [7]. Proliferative markers may be useful in enhancing the prognostic assessment of Oral Squamous cell carcinoma. Ki-67

antigen may be employed as a marker for Oral Squamous Cell Carcinoma and Oral Epithelial Dysplasia [7]. Epithelial dysplasia is a premalignant disease that act as a risk factor for oral carcinoma, which is a multistage process. Significant variation exists when it comes to the diagnosis and grading of oral epithelial dysplasia. Given the close correlation between oral carcinogenesis and the human papillomavirus (HPV), the use of P16 act as a biomarker could aid in identifying the cells that may be undergoing malignant transformation. Nevertheless, dual labeling test P16INK4/Ki67 may be a more promising marker for detecting the transformed cells due to P16 limited specificity [8].

So, in the present study we examined the expression of proteins that regulate the cell cycle P16INK4a and proliferative marker MIB-1 (Ki-67) immunohistochemistry in oral carcinoma.

Materials and Methods

This study is cross-sectional and observe the expression of p16INK4a and MIB-1 in oral malignancies in a tertiary care hospital. This study comprised 100 cases of oral squamous cell carcinoma in total. The clinical data including patient's age, clinical staging were obtained from the pathology records. Incisional and excisional biopsy taken from oral cavity like buccal mucosa, tongue, lips, tonsils were routinely processed after being fixed in 10% buffered formalin. Sections having a thickness of 4-5 μm were cut and stained using Hematoxylin and Eosin stains. The slides were examined using light microscopy, and the information was recorded. Immunohistochemistry of p16INK4a and MIB-1 were also performed on 3-4 μm-thick sections on a poly-L-lysine-coated slides. The data were collected, complied and analysed. Scoring of p16 expression shown in Table 1. Grading of Ki-67 expression shown in Table 2.

Table 1. Scoring of p16 expression

Grade Positivity	**Grade Positivity**
0	<10%
1	1-10%
2	10-50%
3	>50%

Table 2. Grading of Ki-67 expression

Rate of positivity	**Degree of Proliferation**	**Grading**
>50%	High Proliferation	3+
30-50%	Moderate Proliferation	2+
10-30%	Low Proliferation	1+

Ki-67 labelling index was calculated as follows:

$$\frac{\text{No of cells showing positive nuclear staining for Ki67} \times 100}{\text{Total. No. of cells}}$$

The percentage of mitotic count is determined for every 100 cells. In all the cases, the whole epithelium has been surveyed. Approximate calculation of 1000 cells were examined under high power view.

Results

The present study on expression of p16INK4a and MIB-1 in oral malignancies analyses the demographic attributes of the population under investigation. The Demographic details are shown in Table 3.

Table 3. Demographics

Parameter	Value
Age (Mean ± SD)	57 Years
Male	13%
Female	12%
Alcohol use	40%
Tobacco use	92%
Diabetes	20%
Hypertension	24%
Radiation exposure	0%
Family history	0%

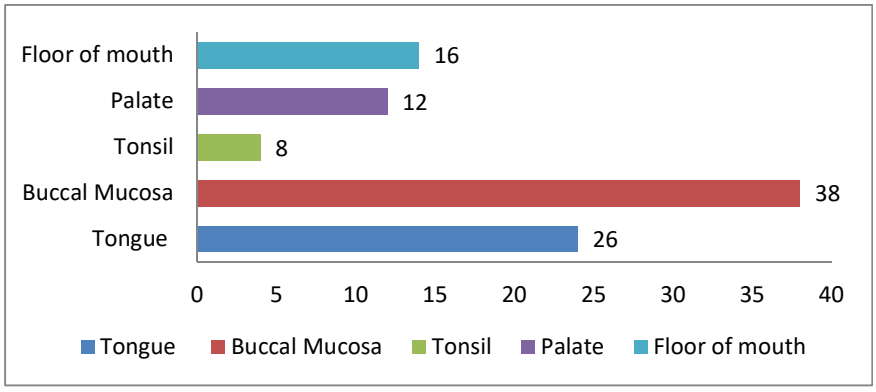


Figure 1. Different sites of distribution of oral cavity malignancies

Table 4. Histopathological grading and typing

Histology Type	Histology grade	Number of cases
Squamous cell carcinoma	Well differentiated	34%
Keratinizing	Moderately differentiated	57%
Squamous cell carcinoma- Non Keratinizing	Poorly differentiated	9%

Table 4 shows displays the different histopathological grades of squamous cell carcinoma. Invasive squamous cell carcinoma histological types are Keratinizing, Non keratinizing and Poorly differentiated. Among the invasive Squamous cell carcinoma, moderately differentiated Squamous cell carcinoma were 57%, followed by the well-differentiated Squamous cell carcinoma (34)% and Poorly differentiated SCC (9%).

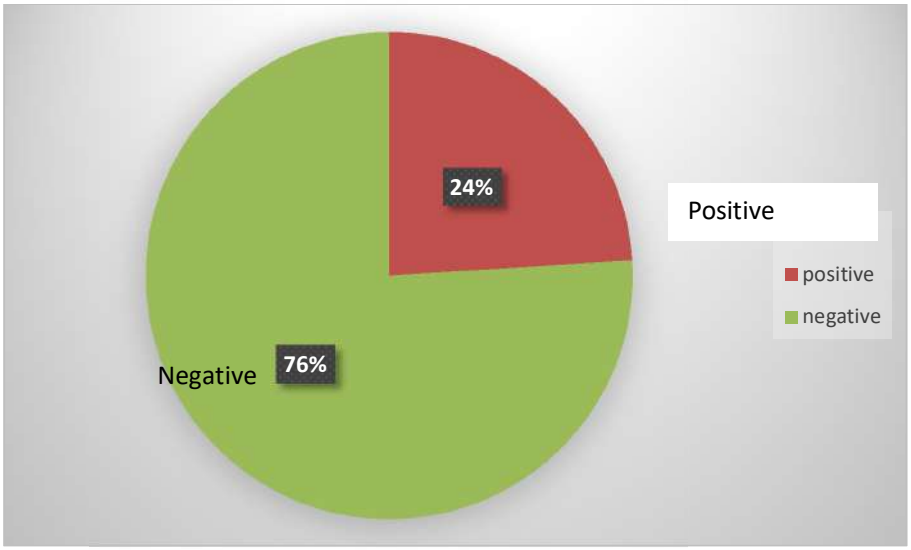


Figure 2. Invasive Oral Squamous Cell Carcinoma with metastatic lymph nodes

Table 5. Expression of Ki-67 and p16 expression in Oral Squamous Cell Carcinoma

MIB-1 (ki67)	p16	
	Positive	Negative
Positive	130	170
Negative	30	30

Table 6. Comparison of p16 in different Histological grades of Oral Squamous Cell Carcinoma

Grade	Grade 0	Grade 1	Grade 2	Grade 3	Total cases
WDSCC	19	9	0	0	28
MDSCC	38	21	4	0	63
PDSCC	6	3	0	0	9

Grade 1 expression of p16 was found to be higher in Moderately differentiated squamous cell carcinoma. (MDSCC) 21 cases followed by Well differentiated squamous cell carcinoma. (WDSCC) 9 cases. Grade 2 expression of p16 was found to be higher in MDSCC with none from WDSCC and Poorly differentiated squamous cell carcinoma (PDSCC). Grade 3 expression of p16 was not found in any type of squamous cell carcinoma.

Discussion

Age of occurrence of squamous cell carcinoma

The mean age of patients involved in the present study is about 57 years (Range from 40-80 years). Omer et al stated in his study, the age ranged from 33 to 89 years, with 64.24 years as the mean age and in which majority of them were males (52.0%) [9]. Saxena et al, in her study found that the patient's age ranged from 31 to 95 years, and the mean was about 53.8 years [3]. Age range of patients with squamous cell carcinoma correlating with both the studies.

Tobacco and Alcohol usage

In the current research, tobacco usage was found in 92% of cases. Alcohol usage noted in 40% of cases [9]. A study done by Mello et al on analysing the results of drinking and smoking on patients with oral SCC had found that the incidence of oral squamous cell carcinoma was positively correlated with synergistic intake with an odds ratio = 5.37 at 95% confidence interval [95%CI] = 3.54-8.14 [10].

Site Distribution

In the present study, commonest tumour site was found to be buccal mucosa (38%) followed by tongue (26%) and the least commonest sites were floor of the mouth (16%), palate (12%) and tonsil (8%). Borse et al. in his study also stated that in recent years, the incidence of the tongue and buccal mucosa cancer increased in India with a higher incidence of carcinoma of buccal mucosa cases [11].

Histopathological grading

In the current research around 34% of cases were diagnosed as well differentiated squamous cell carcinoma, 57% cases were found to be moderately differentiated squamous cell carcinoma, 9% of cases reported as poorly differentiated carcinoma. In our study, moderately differentiated tumors were found to be most common, which varies with the study of Padma et al who stated that in her study 98 (49.5%) accounts for

moderately differentiated carcinoma 32 (16.2%) had poorly differentiated tumors and 68 (34.3%) had well-differentiated carcinomas [12].

Neck Node Metastasis

In the present study around 24% of patients showed metastatic deposits in the regional lymph nodes. Mehta et al in her study found nodal positivity in 33 patients (52.38%) [13].

IHC Expression of Molecular Markers in Oral Squamous Cell Carcinoma

P16 Expression

In our study, on analysing p16 expression, Grade 0 expression is positive in 63 cases, grade 1 expression was seen in 33 cases and 4 cases show grade 2 expression.

Thambiah, et al in their study stated that 45% of high risk potential malignant disorder showed diffuse positivity for p16 [14]. In our study, for p16, none of the Oral squamous cell carcinoma displayed diffuse positivity. Study proposed by Shah et al. found that Oral squamous cell carcinoma with reduced p16 showed expression increasing grades of tumour [15]. Maheswari and Tamilselvi in their study stated that p16 expression was seen in 50% of moderately and poorly differentiated squamous cell carcinomas, while 42.86% of well-differentiated carcinomas of the squamous cell shows expression of P16. Sharada et al. stated that they found a substantial relationship between p16 immunoexpression and dysplasia degree which shows positivity in 16.7% of instances of oral intraepithelial neoplasia I compared to 77.8% and 25% of Oral intraepithelial neoplasia II and III, respectively [2].

Ralli et al stated that in her study, p16 was positive in 78.7% cases and 21.3% cases were negative [16]. Lewis et al., in his study found that of the 239 cases, p16 showed positivity in 187(78%) cases [4].

MIB-1 (Ki-67) Expression

Dysplastic epithelium is characterized by cellular alteration at molecular and genetic level. There is also alteration in the epithelial maturation leading to increased proliferative activity of the suprabasal layer [17].

Pontes et al., study shows in OSCC, the expressions of Ki-67 have demonstrated varying results. According to certain research, the proliferation-associated antigen Ki-67 is one of the most reliable indicators of a patient's prognosis for a number of malignant illnesses, including lung, prostate, and breast cancer [18].

Study conducted by Sharada et al stated that the histological type and grade of the tumor were strongly connected with ki-67 immunoexpression. Malignant cases had higher ki-67 immunoexpression (66.3%) compared to benign cases (10%) and premalignant cases (37%). is seen in poorly differentiated tumours (75%) than well – differentiated tumours (12.2%) [2].

Takkem et al. stated that the expression of Ki-67 antigen may be utilized as a marker for the histological grading of OED and OSCC increases based on how severe the oral epithelial dysplasia [7]. Takkem also stated that in his study the Ki-67 expression was detected in all cases of well-differentiated, moderately and poorly differentiated tumours [7].

Correlation between p16 and MIB-1 (Ki-67)

In our study, expression of p16 and MIB-1 (Ki-67) was significantly correlated. Bharathi et al stated that in her study, dual p16INK4a and in patients below 40 years of age, Ki67 was positive in 5 cases, and 2 cases were positive in patients older than 40. Within the OSCC group, 1 case which was 8 people older than 40 and six patients younger than 40 were positive for Ki-67 [8].

Conclusion

MIB-1 and p16 expression can be used in conjunction with histomorphological features in diagnosis of well differentiated and moderately differentiated oral squamous cell carcinoma and to study their proliferative potential which would provide a significant effect on the therapy.

Statements and Declarations

Conflicts of interest

The authors declares that they do not have conflict of interest.

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ORIGINAL ARTICLE

Sarcopenia Prevalence in Liver Cirrhosis Patients Using MRI and Handgrip Strength Measurements

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Abstract

Background: Cirrhosis, a leading cause of mortality worldwide, is histologically represented as formation of regenerative nodules encircled by fibrous bands caused by chronic liver injury. Nutritional status in cirrhotic patients is challenging to assess due to fluid accumulation resulting from impaired protein synthesis. Factors such as reduced food intake, malabsorption, and altered macronutrient metabolism negatively impact the nutritional status, leading to sarcopenia. The development of sarcopenia is multifactorial and is linked to lower survival rates. **Aim:** To assess sarcopenia prevalence in liver cirrhosis patients using MRI and handgrip strength measurements. **Discussion:** Impaired food intake in liver cirrhosis results from a combination of factors including loss of appetite, hormonal changes, early satiety, ascites, nausea, taste disturbances, and functional dyspepsia. Malabsorption can also occur due to portosystemic shunting, reduced bile production, chronic pancreatitis, and small intestinal bacterial overgrowth, all of which contribute to sarcopenia. It also arises from complex interactions involving impaired glycogen synthesis, inadequate nutrition, disrupted skeletal muscle protein synthesis and underlying hypermetabolism. **Conclusion:** MRI-based assessments indicate there is a significant occurrence of sarcopenia in individuals with cirrhosis. Our findings reveal that handgrip strength, when correlated with MRI results, is a reliable predictor of sarcopenia in these patients.

Keywords: cirrhosis, sarcopenia, MRI, handgrip strength

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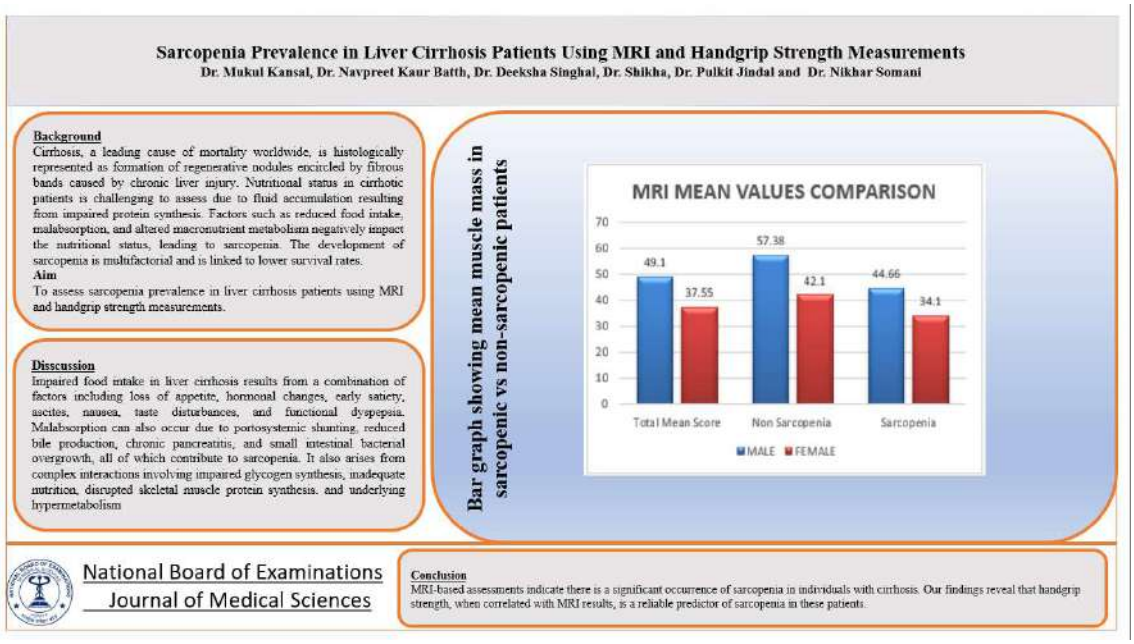
Abbreviations:

BIA	:	Bioelectrical Impedance Analysis
CTP	:	Child-Turcotte-Pugh
CT/MRI	:	Magnetic Resonance Imaging/ Computed Tomography
SPPB	:	Short Physical Performance Battery
MELD	:	Model for End-Stage Liver Disease
IVNAA	:	In-Vivo Neutron Activation Analysis
HGS	:	Hand Grip Strength
DXA	:	Dual Energy X-ray Absorptiometry

Graphical Abstract



Introduction

Liver cirrhosis is histologically represented as formation of regenerative nodules encircled by fibrous bands caused by chronic liver injury leading to portal hypertension and end-stage liver disease [1]. The CTP and MELD scores are currently the best tools for mortality prediction in cirrhosis patients. However, these scores do not evaluate the patients' nutritional and functional status [2]. Nutritional status in cirrhosis is negatively impacted by impaired food intake, malabsorption, and altered macronutrient metabolism. Malnutrition plays a major role in the onset of sarcopenia among patients with cirrhosis [3]. Sarcopenia, a progressive and generalized skeletal muscle disorder, results from impaired glycogen synthesis, impaired skeletal muscle protein synthesis, inadequate nutrition, and underlying hypermetabolism because of the portosystemic shunting present in a cirrhotic liver [4].

Pathophysiology

Multiple factors play a role in the initiation and advancement of sarcopenia. Impaired protein synthesis, neuromuscular integrity, proteolysis, and muscle fat content are few to name. Due to reduced glycogen reserves, lipid and protein

metabolism shifts towards a catabolic pathway, feeding gluconeogenesis. The phosphoinositide 3-kinase/mammalian target of rapamycin signalling pathway plays a significant role in sarcopenia via myostatin and insulin-like growth factor-1. Other hormonal factors may also contribute to the loss of skeletal muscle mass [5]. In patients with cirrhosis, limited functional capacity makes exercising difficult, and gastrointestinal tract alterations reduce food intake, resulting in suboptimal nutrient availability [6]. Additionally, the systemic pro-inflammatory status, triggered by altered gut microbiota and increased intestinal permeability, may further contribute to the development of cirrhosis-associated sarcopenia as shown in Figure 1 [7].

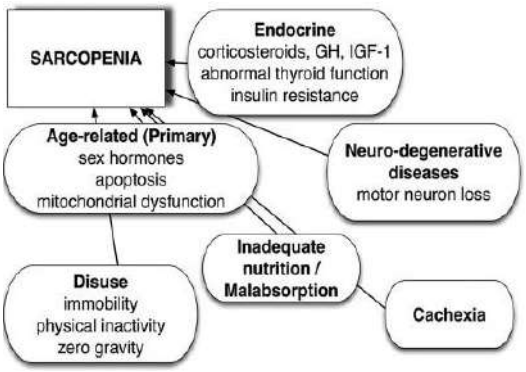


Figure 1. Sarcopenia: Multifactorial causation

Stages of sarcopenia

Sarcopenia can be classified into two types: primary and secondary. Primary sarcopenia, also known as age-related sarcopenia, occurs when aging is the sole apparent cause. In contrast, secondary sarcopenia arises when there are additional contributing factors.[8]

Sarcopenia can be divided into 3 stages: presarcopenia, sarcopenia, and severe sarcopenia. This classification is given by European Working Group on Sarcopenia in Older People as shown in Figure 2.

Stage	Muscle mass	Muscle strength	Performance
Presarcopenia	↓		
Sarcopenia	↓	↓	N or ↓
Severe Sarcopenia	↓	↓	↓

Figure 2. Stages of Sarcopenia

Presarcopenia is the first stage in which the loss of muscle mass has started but it still not has put a significant impact on physical performance or muscle strength. Diagnosis of this stage requires help of techniques that accurately measures muscle mass and then by comparing it to standard population norms.

Sarcopenia is the second stage in which muscle mass loss has already started but there is reduction of one of the two factors: physical performance or muscle strength.

Severe sarcopenia is the third stage and is diagnosed when all three factors are present including low muscle mass, decreased physical performance and reduced muscle strength [9].

Assessment techniques

Contemporary methods for identifying and diagnosing sarcopenia prioritize physical performance measures as the initial step. Evaluating muscle mass follows as the second diagnostic stage [10]. Muscle mass can be measured at various levels of body composition, with the complexity ranging from atomic detection to anatomical measurement as shown in Figure 3 [11]. The research databases were thoroughly searched, resulting in the identification of sixty-two eligible publications that included tools for

assessing physical performance, muscle strength and muscle mass [12].

MRI was employed as the gold standard for assessment of muscle mass due to its excellent resolutions, which allow for detailed evaluation of morphological as well as biochemical properties of muscles. One significant advantage of MRI over other imaging techniques is its ability to detect changes in muscle structure associated with aging and disease progression. MRI also provides accurate insights into intramuscular water and fat content non-invasively [13]. However, due to its high cost and limited accessibility, Cin anthropometric parameters such as handheld dynamometry and gait speed are commonly used to diagnose sarcopenia. The studies found that SPPB or handheld dynamometry with gait speed offer valid and reliable measurements of muscle strength and physical performance, respectively [14]. Muscle depletion and low handgrip strength were defined as <26 kg and SMI <52.4 cm^2/m^2 for men and <18 kg and SMI <38.5 cm^2/m^2 for women [15]. In this study, we aimed to assess sarcopenia prevalence in patients with cirrhosis using two methods: MRI and handgrip dynamometry. We compared the effectiveness of both techniques in determining the prevalence of sarcopenia.

Materials and Methods

The study was conducted on 50 patients with liver cirrhosis, both outpatients and inpatients, who were admitted to the medical wards of the Department of Medicine at Rajindra Hospital. The investigation included patients regardless of the underlying cause of their cirrhosis.

Criteria	Clinical practice	Research
Muscle mass	BIA DXA Anthropometry	IVNAA CT/MRI DXA BIA Total body potassium Ultrasound
Muscle mass	Handgrip strength	Handgrip strength Knee flexion/extension Peak expiratory flow
Physical performance	SPPB Gait speed test Get-up-and-go test Stair climb power test Six-minute walk distance	SPPB Gait speed test Get-up-and-go test Sit-to-stand test Six-minute walk distance

Figure 3. Assessment Techniques for muscle mass and physical performance

Inclusion criteria:

- Age between 18 to 65 years.
- Diagnosed cases of liver cirrhosis
- Patients who gave Informed consent.

Exclusion criteria:

- Patients below 18 or above 65 years.
- Diagnosed HIV or malignancy cases
- Advanced heart, lung, kidney failure patients
- Known cases of malabsorption syndrome
- Known cases of any neuromuscular disease
- Known case of any endocrinal disorder.

Sarcopenia assessment: MRI

Using the available MRI (1.5 Tesla Siemens Magneton Aera) images, the study identified the 3rd lumbar vertebral (L3) level to measure the cross-sectional area of the surrounding muscles. At this site, various muscles which show signs of sarcopenia including the psoas, paraspinals, transversus abdominis, rectus abdominis, internal and external obliques can be measured easily. This level is chosen also because cross sectional area of these muscles' correlates well with whole-body muscle mass. The L3 skeletal muscle area was then normalized to stature by dividing the muscle area by the height squared. Sarcopenia was defined as an L3 muscle area of 52.4 cm^2/m^2 in males and 38.5 cm^2/m^2 in females [16].

Sarcopenia assessment: Handgrip strength

A mechanical handgrip dynamometer was utilized to measure handgrip strength. Patients were seated comfortably in a chair, and the handle of the dynamometer was adjusted accordingly. They were instructed to hold the device away from their body and table. Using their non-dominant hand, patients were asked to grasp and squeeze the handle of the dynamometer with maximum effort. Three measurements were taken, each separated by a gap of more than 30 seconds. The average of these three readings was then calculated. All measurements were recorded in kilograms [17].

Results

The study was conducted on 50 outdoor and indoor patients of liver cirrhosis. The mean age of the patients was 47.22 ± 10.845 years. Maximum patients were observed in age group 41-50 years i.e. 20. There was total 18 (36%) patients without sarcopenia and 32 (64%) patients with sarcopenia. Total 7 females (3 (42.9) without sarcopenia and 4 (57.1) with sarcopenia) and 43 males (15 (34.9) without and 28 (65.1) with sarcopenia were present in the study.

Muscle mass in MRI was measured, analysed and distributed into 2 groups: sarcopenic patients vs non sarcopenic patients. Mean was calculated for both groups as shown in Figure 4 and plotted on graph in Figure 6. It showed negative correlation and implied that sarcopenic patients has decreased muscle mass and vice versa.

GENDER	TOTAL	SARCOPENIA	NON-SARCOPENIA	P- VALUE
MALE	49.10±7.20	44.66±4.26	57.38±2.76	.001**
FEMALE	37.55±4.75	34.10±2.19	42.1±2.21	.005*
TOTAL	47.48±7.97	43.34±5.37	54.84±6.3	.001**

Figure 4. Mean muscle mass in sarcopenic vs non-sarcopenic patients

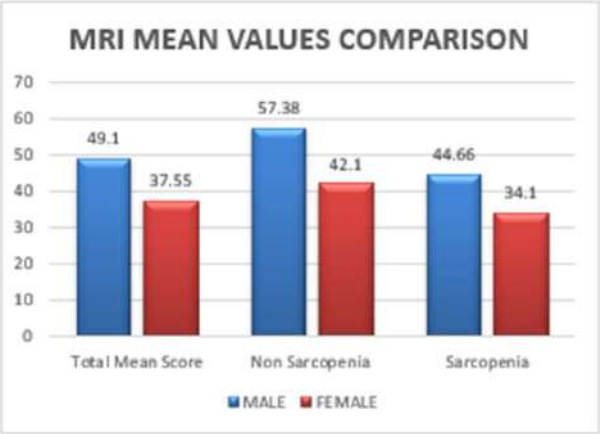


Figure 5. Bar graph showing mean muscle mass in sarcopenic vs non-sarcopenic patients

METHOD	TOTAL	SARCOPENIA	NON-SARCOPENIA	P VALUE
DYNAMOMETER	19.43±3.72	18.39±3.39	21.29±3.64	.007*

Figure 6. Mean HGS in sarcopenic vs non-sarcopenic patients

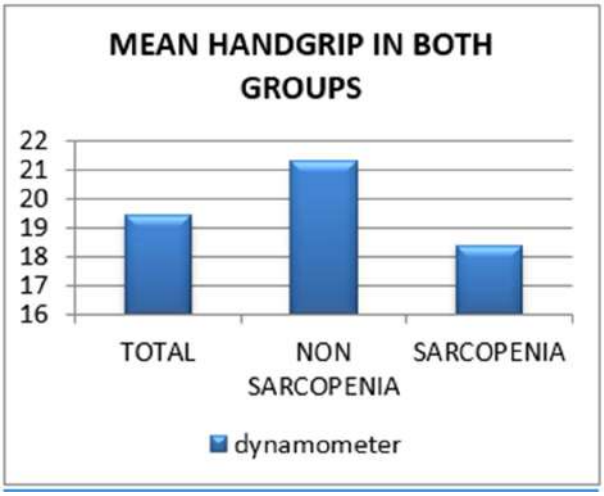


Figure 7. Bar graph showing mean HGS in sarcopenic vs non-sarcopenic patients

Handgrip strength was measured, analysed and distributed into 2 groups: sarcopenic patients vs non sarcopenic patients. Mean was calculated for both groups as shown in Figure 6 and plotted on graph in Figure 7. It showed negative correlation and implied that sarcopenic patients has decreased handgrip strength and vice versa.

Figure 8 shows MRI correlation with handgrip dynamometer in males. MRI was positively and significantly correlated with Handgrip strength showing linear correlation. Figure 9 shows MRI correlation with handgrip dynamometer in females. MRI was positively and significantly correlated with Handgrip strength showing linear correlation.

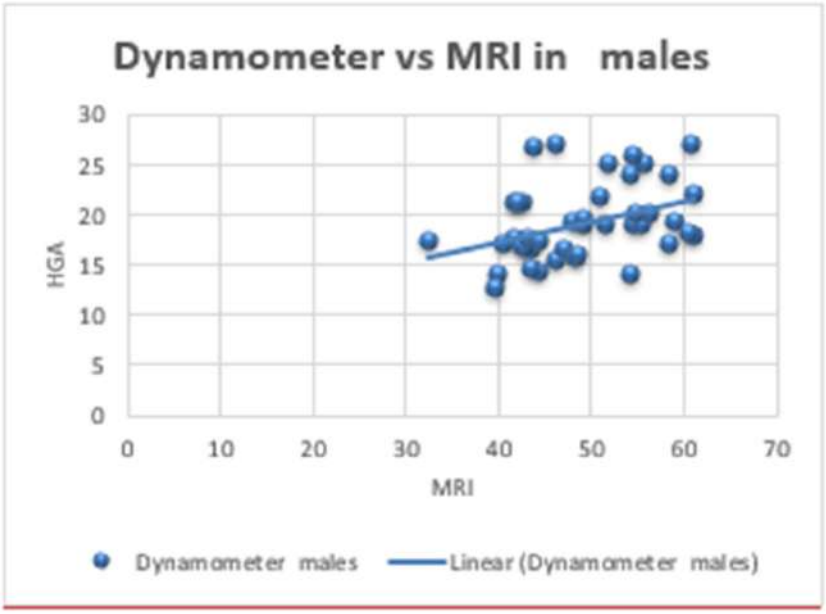


Figure 8. MRI vs handgrip strength in males

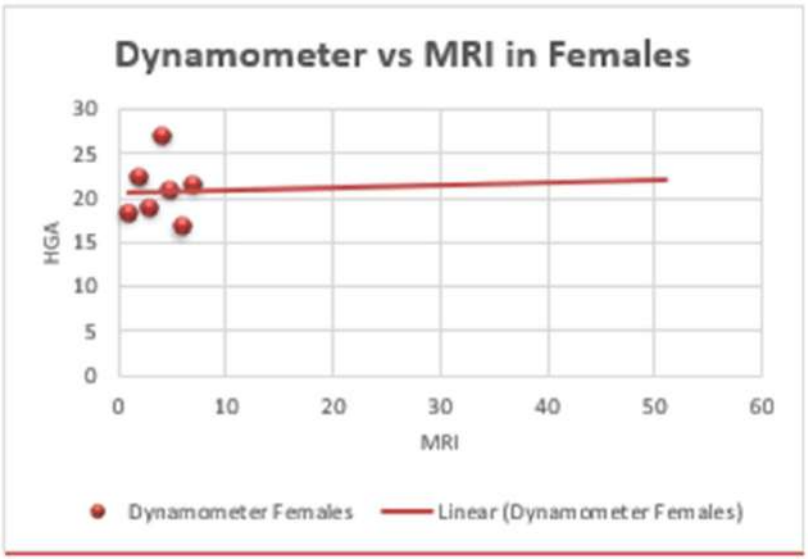


Figure 9. MRI vs handgrip strength in females

Conclusion

The high prevalence of sarcopenia in patients with liver cirrhosis, as assessed by MRI, underscores the importance of accurate diagnostic methods. Our study explored the effectiveness of handgrip dynamometry (HGS) in predicting sarcopenia among these patients. The findings indicate that HGS, when correlated with MRI results, is a reliable predictor of sarcopenia in cirrhotic patients. Interestingly, the etiology of cirrhosis did not influence the occurrence of sarcopenia in our study. While both MRI and HGS are non-invasive assessment methods, HGS stands out for its ease of use.

Future Scope

As the understanding of sarcopenia's impact on clinical outcomes in liver cirrhosis deepens, several key areas warrant further exploration. Firstly, developing standardized MRI protocols for assessing muscle mass can enhance diagnostic accuracy and comparability across studies. Secondly, integrating MRI findings with other biomarkers and clinical parameters can provide a more comprehensive understanding of sarcopenia's multifactorial nature. Additionally, longitudinal studies are essential to evaluate the progression of sarcopenia and its response to various treatments which can help establish the efficacy of interventions like nutritional support, physical exercise, and pharmacological agents. In conclusion, the future scope of researching sarcopenia in liver cirrhosis patients using MRI and handgrip strength is vast and promising.

Conflicts of interest

The authors declares that they do not have conflict of interest.

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CASE REPORT

Maternal Immune Thrombocytopenic Purpura Leading to Severe Neonatal Autoimmune Thrombocytopenia: Report of Two Cases

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Abstract

Introduction: In neonatal intensive care units, neonatal thrombocytopenia is one of the common hematological abnormality seen. Neonatal autoimmune thrombocytopenia should be considered in any neonate who is born to a known case of immune thrombocytopenia purpura (ITP) mother, with early onset thrombocytopenia without any signs of sepsis. Neonatal ITP is a condition of autoantibody mediated platelet destruction. **Case details:** Two neonates with thrombocytopenia, born to mothers with ITP are described in this report. Lowest platelet count noted was 7000 cells/cmm in one of the neonate. Both neonates received intra venous immunoglobulin (IVIG) while one neonate had persistent and severe thrombocytopenia requiring multiple random donor platelet (RDP) transfusions followed by oral steroid as well. **Conclusion:** Neonatal thrombocytopenia associated with maternal ITP need close monitoring, early sampling and diagnosis to prevent any possible complications and warrant early initiation of treatment.

Keywords: Neonatal Thrombocytopenia, ITP, IVIG, Immune thrombocytopenia

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Introduction

Immune thrombocytopenia is an autoimmune disorder characterized by low platelet counts due to accelerated destruction by autoantibodies. The incidence of ITP in pregnancy ranges from 1,000-10,000 pregnant mothers accounting for 3-5% of thrombocytopenia in pregnancy. Among the neonates born to mothers with ITP Incidence is around 10-25% [1].

Thrombocytopenia is classified on basis of time of onset as early onset (at <72 hours of life) or late onset (at > 72 hours of life) and on basis of total platelet count as mild (platelet count 1,00,000-1,50,000/cmm), moderate (platelet count 50,000-1,00,000/cmm), severe (platelet count < 50,000/cmm) [2].

Neonatal thrombocytopenia is milder when associated with maternal autoimmune thrombocytopenia than isoimmune thrombocytopenia. Bleeding manifestations like mucocutaneous bleeds, gastrointestinal and umbilical bleeds are less common [1].

This report details two neonates with thrombocytopenia, born to mothers with ITP.

Case 1

A female baby was born at 38 weeks 5 days of gestation to a 32 years old primigravida mother via normal vaginal delivery, weighing 2825 grams. The mother has been diagnosed of ITP from last 5 years and was on oral steroids (prednisolone). She underwent splenectomy 7months prior to delivery. Her platelet count was 58000/mm3 and had received RDPs prior to delivery. She was normotensive and rest of her antenatal period was uneventful.

The baby cried immediately after birth with APGAR of 9,9 at 1min and 5 min of life respectively. Baby was shifted by mother side for exclusive breast feeding. On examination baby did not have any evidence of bleeding such as bruising, bleeding from oral mucosa or any other site.

Given the mother's history of ITP, initial platelet count of baby done at 24 hours of life was 7000/mm3 with peripheral blood film suggestive of large platelets. All other biochemical parameters were within normal limit. Due to early onset severe thrombocytopenia, baby was shifted to neonatal intensive care unit (NICU). After sending septic workup, considering the risk of massive bleed, she was transfused with RDP and started on IVIG @ 2mg/kg (over 2 days). Neurosonogram (NSG) done in view of severe thrombocytopenia, was normal with no evidence of Intra Cranial Haemorrhage. There was no evidence of bleeding from any site and baby was clinically well. After IVIG transfusion, on serial monitoring, platelet count improved to 50,000/mm. RDP were transfused at platelet count below 30,000/mm3. On day 5 of life, again platelet count decreased to 19,000/mm3, so RDP and 2nd dose of IVIG @ 2mg/kg (over 2 days) was given. Repeat USG head was normal. Septic screen workup was negative. As platelet count was persistently below 50,000/mm3 by day 9 of life, oral steroid (prednisolone) was added and was stopped once platelet count improved.

Table 1. Overview of laboratory workup done for the neonate.

Laboratory Parameter (day of life)	Haemoglobin (g/dl)	Total Leucocyte Count (cells/cmm)	Platelets (cells/cmm)	CRP (mg/dl)	Blood C/S	NSG
DAY 2	19.6	18100	7000	4.86	Sterile	Normal
Day 3	19	13700	10000			
Day 4	18	13200	50000			
Day 7	17.3	22400	20000			
Day 8	17.2	11900	25000			
Day 9	17.4	8800	21000			

Case 2

A male baby was born at 37 weeks 5 days of gestation to a 33 years old G2P1L1 mother by lower segment cesarean section (LSCS) (indication- previous LSCS in labour) with birth weight of 2980 grams. Mother is a known to have ITP with a platelet count of 90,000/cmm at the time of delivery. She was normotensive and rest of her antenatal period was uneventful.

Baby cried immediately after birth with APGAR of 9,9 at 1min and 5 min of life respectively. Baby was moved to mother's side for exclusive breast feeding. Upon examination, the baby showed no signs of bleeding, such as bruising or bleeding from oral mucosa or any other site.

As Mother is a k/c/o ITP, complete blood count of neonate was done at 24 hours of life that showed platelet count of 93000/mm3. On serial monitoring platelet count reduced to 36,000/mm on day 5 of life. In view of severe thrombocytopenia, baby was shifted to NICU and was started on IVIG @ 2mg/kg over 2 days. NSG done in view of severe thrombocytopenia was normal and there was no Intra Cranial Haemorrhage. There was no evidence of

bleeding from any site and baby was clinically well. After IVIG transfusion, on serial monitoring platelet count improved to 1,71,000/mm. This baby did not require RDP transfusion as lowest platelet count recorded was 36000/cmm.

Table 2. Overview of laboratory workup done for the neonate

Laboratory Parameter (day of life)	Haemoglobin (g/dl)	Total Leucocyte Count (cells/cmm)	Platelets (cells/cmm)	Neurosonogram
Day 2	14.4	13700	93000	Normal
Day 4	15.5	88000	74000	
Day 5	15.4	10500	36000	
Day 6	14.1	9300	67000	
Day 9	13.5	9800	171000	

Discussion

The incidence of thrombocytopenia in neonates born to mothers with immune thrombocytopenic purpura ranges from 20 to 80% with 10-30% of neonates experiencing severe thrombocytopenia [1].

Mothers with ITP require frequent platelet count monitoring in antenatal period. If the Platelet count is greater than 30,000/cmm, no therapy is generally required. However treatment is imperative if the platelet count is below 30,000 /cmm or if 10 days prior to any planned procedures bleeding occurs. Prednisolone is started as 1st line of therapy with platelet transfusion at counts below 30,000/cmm. Other options available are IVIG, azathioprine, methylprednisolone and splenectomy. Minimum platelet count required prior to cesarean section and and for epidural anesthesia is 50,000/cmm and 80,000/cmm respectively [2].

Mothers with ITP or autoimmune disease such as systemic lupus erythematosus produces antiplatelet antibodies against platelet glycoproteins IIb-IIIa or Ib-IXxcomplex. Transplacental transfer of these antibodies during pregnancy leads to accelerated destruction of platelets of neonates leading to neonatal ITP [3]. Other possible mechanism is cytotoxic T cell or complement mediated destruction.

Neonatal ITP is suspected when neonates is healthy, typically not sick, has mild to moderate thrombocytopenia, it is early in onset, associated with maternal ITP or autoimmune disease, resolves within a week without major bleed [4].

Newborns with neonatal ITP may exhibit mucocutaneous bleeding. Although mucocutaneous bleeds, gastrointestinal and umbilical bleeds are less common and the risk of intracranial haemorrhage is also below 1% [5]. Neurosonogram should be performed in all neonates with platelet count <50,000/cmm.

Treatment options include RDP (@15ml/kg) and IVIG (2mg/kg IV for 2 consecutive days) provided there is bleeding or platelet count is under 30,000/cmm. If the platelet count is between 30,000 to 50,000/cmm without active bleeding, IVIG alone can be given. Persistent thrombocytopenia warrants the need of second dose of IVIG [6].

Thrombocytopenia usually resolves in a week with nadir of platelet count occurring between 3-7 days and rarely persists till 4-6 weeks [7].

Fetal thrombocytopenia can occur as early as 20 weeks of gestation [8].

In our first case, neonate required multiple RDP transfusions and two doses of IVIG followed by oral steroids due to persistent thrombocytopenia.

Whereas in second case, neonate required only single dose IVIG and platelet count improved gradually.

Conclusion

Though neonatal thrombocytopenia associated with maternal ITP is generally mild or moderate but some neonates may have early onset severe thrombocytopenia for several days post delivery. Such neonates need close monitoring, early sampling and diagnosis to prevent any possible complications and warrant early initiation of treatment.

Statements and Declarations

Conflicts of interest

The authors declares that they do not have conflict of interest.

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CASE REPORT

Polyarticular Juvenile Idiopathic Arthritis leading to Renal Amyloidosis

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Abstract

The incidence and prevalence of renal amyloidosis is rare. We are presenting a case of 21 year 21-year-old male with multiple joint pain complicated by adult-onset Nephrotic Syndrome due to renal amyloidosis. The patient improved on medications.

Keywords: Renal Amyloidosis, Polyarticular Juvenile Idiopathic arthritis (JIA), Nephrotic syndrome

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Introduction

Juvenile idiopathic arthritis (JIA) is the most common systemic inflammatory disease of the connective tissue in the pediatric age group [1]. It is classified into several groups based on the number of joints involved along with other clinical and laboratory parameters. One such subset is polyarticular JIA which is characterized by involvement of greater than 4 joints in age less than 16 years.

Amyloidosis is characterized by the systemic deposition of amyloid fibrils. It has many subtypes. One such subtype secondary Amyloidosis caused by the overproduction of the precursor of AA protein [2,3].

Renal amyloidosis has been described in systemic onset JIA, followed by polyarticular JIA [3,4]. Renal amyloidosis has an insidious progress. Initially, there is massive proteinuria which later leads to end-stage renal disease. Hematuria is rarely seen in this condition [3,5]. Asymptomatic proteinuria is the most common initial symptom [2]. Therefore, routine urinalysis should be performed in those who have systemic JIA or polyarticular JIA. Amyloidosis is confirmed by renal biopsy which demonstrates amyloid fibrils.

Case Report

The case is about a 21-year-old male who presented to us with bilateral pedal edema from the last 6 years. For the last 2 years, he has been taking medications from a local practitioner. He also gave a history of frothy urine without any hematuria or decreased urine output or fever.

On examination, there was pallor and bilateral pitting pedal edema. Investigations revealed normal blood counts and renal function tests. Serum albumin was low (2.2g/dl). Total Cholesterol, LDL, and Triglyceride levels were high (429mg/dl,147 mg/dl and 235 mg/dl respectively). Urine routine and microscopy showed 3+ proteinuria with no RBCs. 24-hour urinary protein was quantified as 4.1g/day. Ultrasound of the kidney, ureters and bladder showed bilateral normal-sized kidneys and normal echogenicity with normal cortico-medullary differentiation.

He had joint pains involving the small joints of his hands including metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints over the past 6 years. He had no fever nor had any rash over his body. There was swelling and deformity of fingers. ESR and CRP were raised (ESR-48 mm in 1st hour and CRP- 22mg/dl respectively). Rheumatoid Factor, anti-CCP, and ANA came out to be negative. Diagnosis of polyarticular JIA was made based on the above findings.

The patient was taken up for renal biopsy which revealed glomeruli with diffuse irregular mesangial matrix expansion with staining with IHC for SAA protein showing intense (3+) positivity along glomerular and extraglomerular sites of amyloid deposition. Electron microscopy showed focal effacement of visceral epithelial foot processes with mesangial and subendothelial aggregates of randomly oriented fibrillary structures and no immune complex type electron-dense deposits in glomerular basement membrane or mesangial areas. The patient was started on steroids at 1 mg/kg (40 mg) and gradually tapered over 4 months to maintenance dose of 7.5 mg, with methotrexate 15 mg weekly , HCQS 200 mg once a day and diuretics. He was followed up for 9 months. After 9 months,

his joint pain and pedal edema had subsided with a reduction in 24-hour urinary protein (1.9g/day). His serum albumin improved to 3.4 g/dl. ESR and CRP came back to normal and Urine routine and microscopy showed 1 + proteinuria and no RBCs were seen.

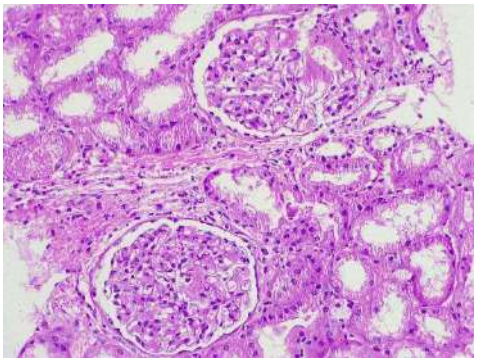

Figure 1. Light microscopy showing expansion of mesangial matrix due to deposition of amyloid (eosinophilic on HE stain at 10x)

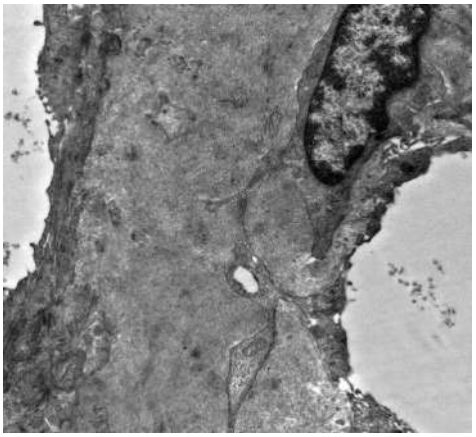

Figure 2. Electron Microscopy showing effacement of foot processes

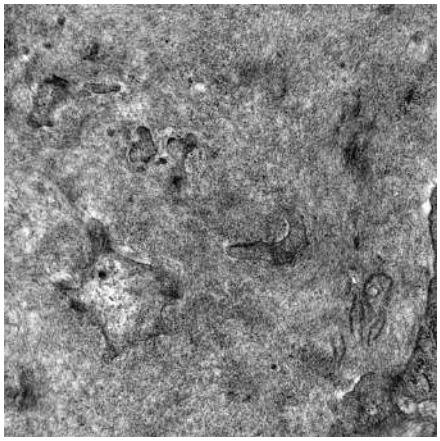

Figure 3. Mesangial and subendothelial aggregates of randomly oriented fibrillary structures measuring about 9-12 nm in diameter

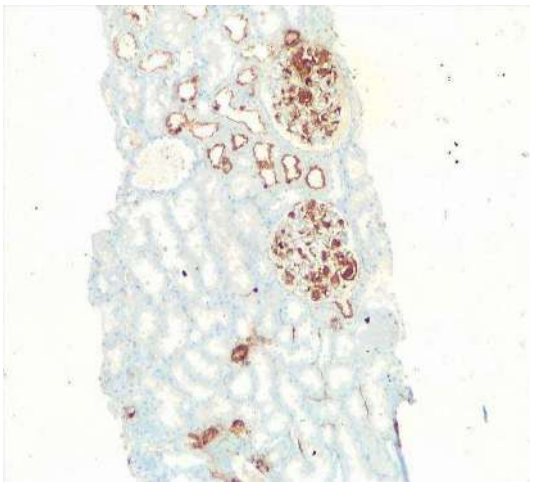

Figure 4. IHC for SAA protein shows intense (3+) positivity along glomerular and extraglomerular sites of amyloid deposition

Discussion

In children, amyloidosis involving the kidneys is rarely seen. The prevalence of renal amyloidosis is higher in patients suffering from JIA compared to the general population [6]. Amyloidosis is described in systemic JIA and polyarticular JIA due to chronic inflammation [6]. In developed countries not many cases of renal amyloidosis are seen [7]. The time duration between the onset of JIA and progression to amyloidosis has been reported to be approximately 8 years [6].

Evidence regarding the management of secondary amyloidosis is scarce and treatment mainly focuses on managing the underlying etiology. Adequate control of underlying disease needs to be achieved. TNF-α inhibitors, IL-1 inhibitors, and Chlorambucil have shown promising results. Tocilizumab has been used extensively in systemic JIA with some success. However clinical remission of proteinuria may not be achieved, and this condition would require prolonged therapy with periodic monitoring [7]. Tocilizumab may be an important therapeutic strategy in such cases where amyloidosis is not completely resolved.

In our case, there was symptomatic proteinuria, and the patient did not have any hematuria. The patient responded to steroids and DMARDs. There are rare publications on patients with systemic JIA having Amyloidosis and even rarer on the association of Polyarticular JIA with amyloidosis.

Conclusion

Renal amyloidosis is an uncommon yet important complication of polyarticular JIA. Clinicians should be vigilant in monitoring renal function in JIA patients. Timely recognition and appropriate management with the available options can improve outcomes.

Statements and Declarations

Conflicts of interest

The authors declares that they do not have conflict of interest.

Funding

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CASE REPORT

Cerebral Venous Thrombosis in a Term Child: A Case Report

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Abstract

Thrombosis of cerebral venous sinuses is a rare condition but can be associated with serious clinical consequences. Pathogenesis of thrombosis of cerebral venous sinus is still not clear. As there is diverse etiology but presentation is subtle, it often leads to delay in the diagnosis. We are reporting the case of a term male neonate born by LSCS (indication obstructed labour with meconium stained amniotic fluid) with diagnosis of severe birth asphyxia, Hypoxic Ischemic Encephalopathy- stage II, probable sepsis, shock and Germinal Matrix Haemorrhage. The magnetic resonance imaging (MRI) of brain and magnetic resonance (MR) venogram done at 2 weeks of age showed superior saggital sinus thrombosis. Baby received anticoagulation therapy and extensive workup was done. Early neuroimaging in all the babies who has neonatal seizures will improve the identification and will warrant early treatment.

Keywords: Cerebral venous thrombosis, Neonatal thrombosis, Prothrombosis

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Introduction

Thrombosis of cerebral venous sinuses is a rare but potentially a life threatening condition in neonates with a prevalence of 1.4-12 per 100,000 live births [1]. Its etiology is diverse with dehydration being the most common cause. The other associated conditions are sepsis, hypercoagulable conditions like polycythemia, deficiency of Protein C and/or Protein S, deficiency of antithrombin III, factor V leiden and mutation of G20210A prothrombin gene [2-4]. Additionally the risk factors during pregnancy like chorioamnionitis, preeclampsia, eclampsia and gestational diabetes mellitus (GDM) may also be associated and leading to thrombosis in neonate [5].

Being described first as rare and fatal condition in 19th century [6], its most common manifestations are seizures and altered sensorium [7].

Case Report

A term male neonate was born to 31 years old G3P2L2 mother from non consanguineous marriage, at 38 weeks 6 days of gestation by LSCS (indication obstructed labour) weighing 3185 gms. Mother experienced antenatal complications of obstructed labour, MSAF grade 3 and mild anemia. Baby suffered from severe birth asphyxia, seizures within 24 hours of birth with hypoxic ischemic encephalopathy stage II (HIE–II). Later he developed shock. The neurosonogram done on day three of life showed germinal matrix hemorrhage (GMH) grade 1 on left side and grade II on right side. Baby required ventilator support for 7 days followed by continuous positive aiway pressure (CPAP) support for 4 days and oxygen for 2 days. Central line was removed after 7 days. The family history revealed history of hemiparaesis and developmental delay in elder sibling.

Investigations

Laboratory findings indicated hyponatremia (S.Na levels-127 mEq/L), hypocalcemia (S.Ca levels-6.3 mg/dL), anemia, elevated CRP (61.43mg/dL), yeast like cells in urine and metabolic acidosis. Blood culture and urine culture were sterile. Mother's high vaginal swab showed growth of staphylococcus aureus. Neurosonogram (NSG) showed germinal matrix haemorrhage (GMH) grade 1 on left side and grade II on right side. The electroencephalography (EEG) was normal. The magnetic resonance imaging (MRI) of brain done at period of 2 weeks of life showed superior saggital sinus thrombosis. Coagulation profile (PT, APTT, INR) was normal. The magnetic resonance venogram confirmed MRI the findings (Figure 1-3). Further workup revealed normal Homocysteine levels (17.4 umol/L), normal Protein C activity of 94.4% (chromogenic) and free Protein S levels of 92% (immunoturbidometry). The next-generation sequencing (NGS) testing showed heterozygous missense variant of uncertain significance on EXON 2 , PROS1 deletion , AD- Protein S , AR- protein S deficiency.

Treatment

Baby was started on IV anticoagulation with low molecular weight heparin (LMW) {Inj Enoxaparin (dose

1.5mg/kg sc q12H)} and after 5 days was switched to oral anticoagulant Warfarin (loading dose of 0.2mg/kg, then 0.32mg/kg OD orally) with monitoring of international normalized ratio(INR) between 2-3.There was no repeat seizure once baby was started on anticonvulsant monotherapy. The infant was discharged on 28th day of life, in a stable condition on exclusive breast feeding and on anticonvulsant (phenobarbitone at maintenance dose of 5 mg/kg/day) and Warfarin at doses titrated as per INR values. Later baby was shifted to Rivaroxaban (oral anticoagulant, factor Xa inhibitor) and warfarin was stopped. At age of three month, rivaroxaban was discontinued and phenobarbitone was gradually tapered and stopped as neonate was neurologically stable and there were no repeat seizures. At three months age, baby is developmentally normal and repeat neurosonogram (cranial+doppler) illustrated partial recanalization of superior saggital sinus. In the follow-up period, at six months of age there was mild interval decrease in superior saggital sinus thrombosis with partial recanalization on neurosonogram. Repeat MRI brain will be done at 1 year of age. The neurodevelopment assessment of the baby till 9 months of age, appears to be normal.

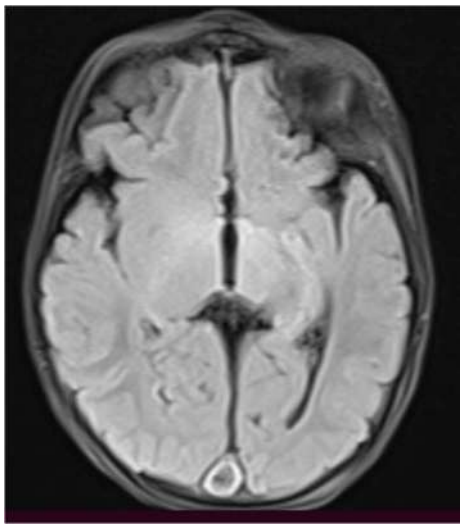

Figure 1. MRI Brain (Axial view): Prominent Superior Saggital Sinus

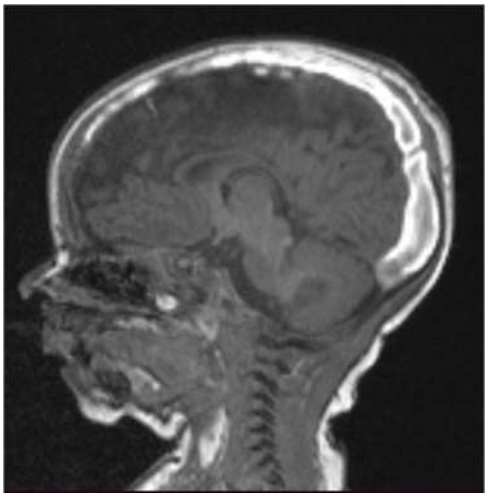

Figure 2. MRI Brain (Coronal section): Prominent Superior Saggital Sinus

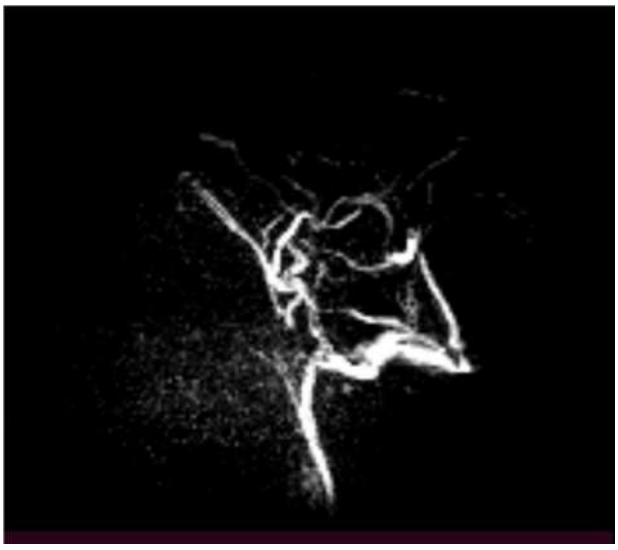

Figure 3. MR Venogram- No flow signal was identified in superior saggital sinus representing underlying thrombosis

Discussion

Neonatal venous sinus thrombosis is a rare condition with prevalence of 1.4-12 per 100,000 live births [1]. It is mainly caused by combination of various factors triggering prothrombosis like presence of birth asphyxia, dehydration, dysfunction of the liver, inflammation, presence of risk factors in mother, central venous long lines, septicemia and premature [2-4]. Furthermore at birth, the neonatal hemostatic system has reduced levels of multiple procoagulant proteins like coagulation factors (II,VII,IX,X) that are dependent on vitamin K, protein C, protein S, anti-thrombin and heparin cofactor II. They might be augmenting the risk of developing thrombosis over the older children as well [8].

Manifestations of neonatal sinus thrombosis vary with age and the most common presentation being seizures in neonates. The clinical symptoms and signs in neonates are often subtle and nonspecific

with increased risk of deranged neurological sequelae. The other primary features of presentation include lethargy, excessive irritability, decreased feeding, apnea, variation in muscle tone and neonatal seizures [9].

Cranial Doppler ultrsonography provides an initial assessment for suspected diagnosis but MRI brain reveals intraparenchymal haemorrhage and different phases of sinovenous thrombosis [10,11]. In our case report neurosonogram showed GMH only and could not pick up thrombosis but MRI brain revealed superior saggital sinus thrombosis.

Mine Ozdil reported a case of term neonate in early period of life with diagnosis of thrombosis of cerebral venous sinus and chronic hemorrhagic ischemia. There was history that this neonate was born to a mother who had been infected with COVID 19 infection in her last trimester. COVID-19 infection is speculated as pathogenic causes that exaggerated the hypercoagulability state leading to neonatal thrombosis [12]. The baby, on extensive workup, was found to have heterozygous MTHFR A1298C mutation but is not linked to elevated homocysteine levels and hypercoagulability. This mutation is common in Turkish population but it is found to be significant if it is associated with MTHFR C677T mutation also [13].

Another case report on cerebral venous sinus thrombosis by Jani S et al, was of a seven-day-old female term neonate who was reported to the emergency department with decreased responsiveness, poor feeding and neonatal seizures. There was history of inadequate breast feeding and significant weight loss (20%).She had hypernatremic dehydration and on magnetic resonance imaging of the brain there was a stable IVH within all the ventricles of brain. On arterial and venous angiography, there was no flow in the intracranial arteries and no flow in dural venous sinuses respectively, suggestive of cerebral venous sinus thrombosis [14]. Similar presentation was also reported by Maghsoudi et al. on neonatal sinus thrombosis with underlying history of hypernatremic dehydration [9].

As neonatal thrombosis of sinuses has diverse etiology and the clinical features are highly variable so the diagnosis is grueling and needs a high degree of suspicion. The analysis of multiple predisposing risk factors in mother during antenatal period, fetal and neonatal period and pro-thrombotic factors contributing to thrombosis is done by case to case basis but the mainstay of the treatment for neonatal thrombosis includes stabilization of vitals, controlling seizures, treating the root cause that may have predisposed the neonate to risk of thrombosis along with anticoagulation therapy [1].

Conclusion

The inherited or acquired thrombophilia in neonates can significantly elevate the coagulation potential, particularly when merged with other risk factors. The clinicians should be prudent in monitoring of sick neonates for thrombotic complications. Early neuroimaging is strongly recommended along with intensive care management for the favourable outcomes.

Statements and Declarations

Conflicts of interest

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CASE REPORT

Borderline Lepromatous Leprosy Masquerading as Granuloma Annulare: A Case Report

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Abstract

Background: Leprosy is a chronic granulomatous disease caused by Mycobacterium Leprae. Leprosy is a great imitator with its various atypical, unusual and varying clinical presentations which can be confused with many infectious and non-infectious diseases. **Case Report:** A 46-year-old female presented to the dermatology department with complaints of painful raised lesions over face, upper back, upper limbs, lower legs and feet for 12 months. Clinically suspected as a case of Granuloma annulare. Punch biopsy was taken which revealed epidermis with dermis showing nodules of histiocytes and lymphocytes with grenz zone at the dermoepidermal junction. Acid fast stain and Fite Faraco stain was performed which revealed the presence of leprae bacilli with bacteriological index of 4+. **Conclusion:** Detailed history-taking and correlating clinical picture with morphology is required to diagnose atypical presentations of leprosy. Early diagnosis helps to provide appropriate treatment and thus prevent from devastating complications.

Keywords: Lepromatous leprosy, Hansen's disease, Granulomas, Granuloma annulare

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Introduction

Leprosy, caused by Mycobacterium Leprae is a chronic granulomatous infection affecting mostly skin and mucous membrane. As per World Health Organization, in 2020, 127,558 new cases of leprosy was detected worldwide [1,2]. Even nowadays new leprosy cases were detected in tropical regions like India [3]. Leprosy usually presents with wide spectrum of clinical features, most common being hypopigmented, hypoasthetic skin lesions, thickened subcutaneous nerves, and the diagnosis is confirmed by the presence of acid fast bacilli. Using histopathological findings, skin-slit smear and acid fast staining of the bacteria and the bacterial index, Ridley-Jopling classification of leprosy categorize the disease into 5 types- tuberculoid to lepromatous leprosy [4]. Emerging newer forms of clinical presentation of leprosy includes bullae with hematoma and xanthoma like presentation. The disease can be contagious and can also presents with unusual presentations such as crippling complications, so timely diagnosis and management of leprosy is extremely important [5].

Granuloma annulare (GA) is a benign, self-limited cutaneous disorder seen as either localized or generalized variant. Localized lesion presents as annular groups of skin-colored to erythematous papules and plaques in dorsal hands or feet. Other uncommon variants are disseminated papular GA, and atypical generalized GA, subcutaneous GA, perforating GA, providing a way for wide spectrum of clinical lesions [6].

Based on the cell-mediated immune response of the individual, the types of leprosy vary from tuberculoid to borderline leprosy [7]. To aid in treatment decisions, the World Health Organization (WHO) classified leprosy based on the bacillary index and involvement of skin and nerves, into PB and MB leprosy [7]. Leprosy is currently diagnosed by clinical and microbiological evaluation using SSS [8,9].

Due to unusual presentations, it delays the diagnosis and management. In those cases, histopathology comes to rescue in confirming the diagnosis [10,11].

Here we present a case of Borderline lepromatous leprosy which was masquerading as Granuloma annulare.

Case Report

A 46-year-old female presented to the dermatology department with complaints of painful raised lesions over face, upper back, upper limbs, lower legs and feet for 12 months. The patient was apparently normal before 12 months, later which she developed skin lesion which was insidious in onset. No history of photosensitivity. No history of known comorbidities like Diabetes mellitus and hypertension. General examination and vitals of the patient were normal. On local examination of skin, multiple erythematous and indurated plaques were noted predominantly over Upper arms, forearms, and upper back. A few of the lesions showed central hypopigmentation and sloping periphery mimicking granuloma annulare. Indurated nodules were seen on the back, forearm and lower legs (Figure 1).

Figure 1. Multiple erythematous plaques over back (A),upper limb (B,C).

Based on the clinical presentation, the following differential diagnoses were considered- Granuloma annulare, Tumid lupus erythematosus, Scleroderma, and lupus panniculitis. Punch biopsy was taken from two different sites, one from medial aspect of left lower leg and another from the upper back lesion. The specimen was examined and processed in the Histopathology laboratory. Microscopically, multiple sections studied showed epidermis with attenuated rete ridges. A clear grenz zone was seen under the epidermis. Dense cellular infiltrate of predominantly histiocytes with scanty lymphocytes were seen destroying the cutaneous appendages extending into the subcutaneous fat. These histiocytes showed eosinophilic to pale foamy cytoplasm. These activated epithelioid cells were seen forming ill -defined granulomas (Figure 2).

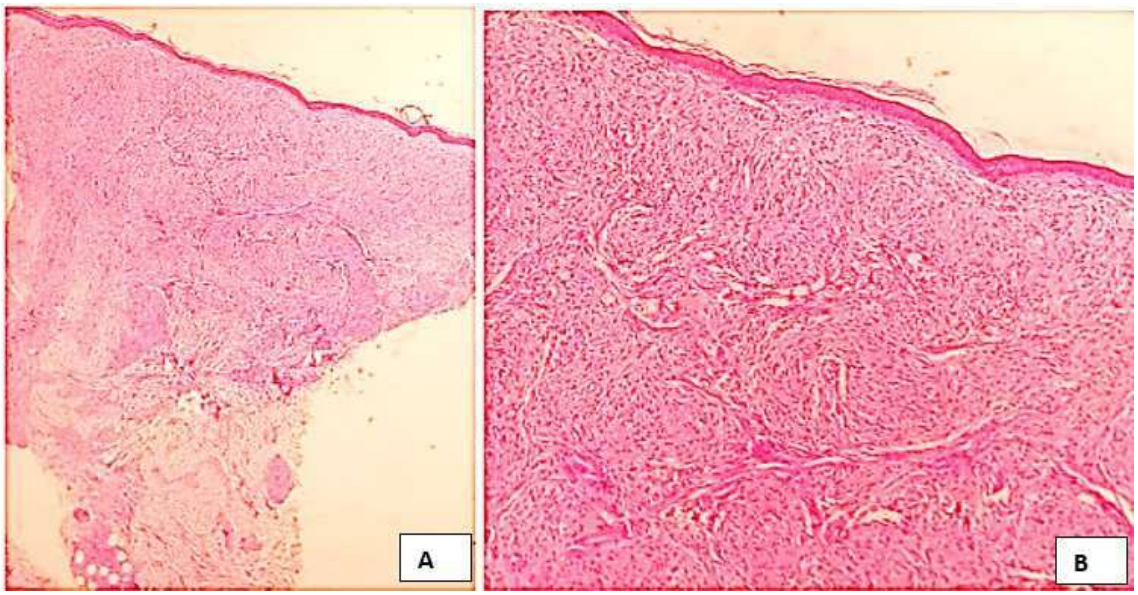

Figure 2. **A:** Histopathology showing thin epidermis, with a narrow grenz zone and dermis showing cellular granulomatous infiltrate. [H&E stain, 100x] **B:** Histopathology showing multiple ill-defined granulomatous infiltrates. [H&E stain, 400x]

Dermal edema and altered collagen were also seen which overlapped with the findings of granuloma annulare, hence Alcian blue stain was performed to rule out the presence of mucin. Alcian blue stain was found to be negative for mucin. Overall findings raised the suspicion of Hansen's disease, so Acid fast stain and Fite Faraco stain was performed for further evaluation. Both stain showed pink rod shaped bacilli with a bacteriological index of 4+ (Figure 3).

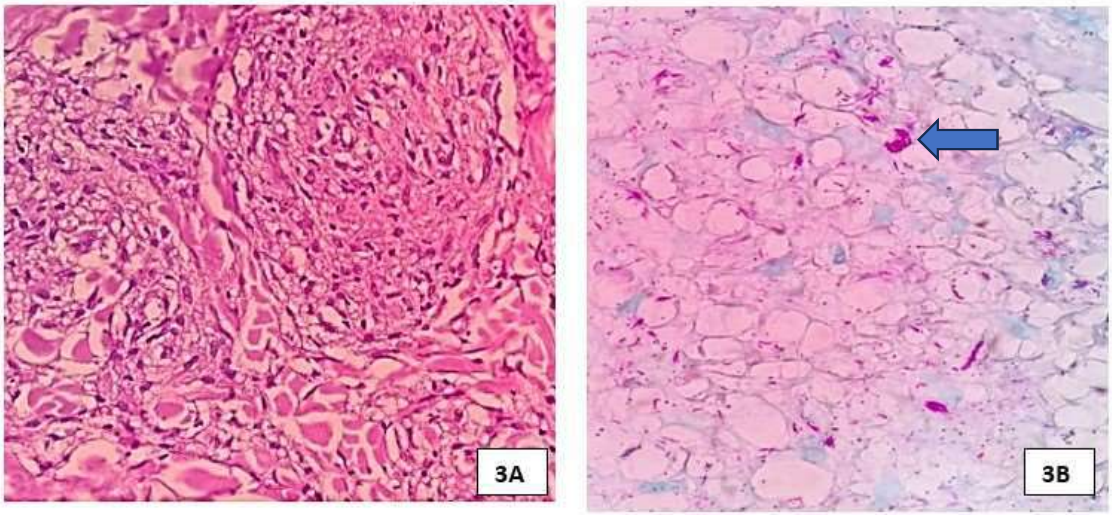

Figure 3. **A:** Histopathology showing ill-defined granuloma with collection of epitheloid histiocytes. **B:** Fite faraco stain showing globi of lepra bacilli [Fite- Faraco stain, 1000x]

Discussion

Leprosy, a chronic granulomatous infection caused by Mycobacterium leprae affects ost commonly the skin and peripheral nerves.[12] Ridley Jopling classification categorized leprosy based on its clinical, histopathological, and immunological findings into 6 groups.[13,14] Borderline leprosy is between tuberculoid and lepromatous leprosy [13,14].

The diagnosis of leprosy needs one of three criteria (1) hypopigmented or erythematous skin lesions, such as macules or plaques, with loss of skin sensation; (2) thickening or enlargement of the peripheral nerves and signs of nerve damage and for microbiological confirmation (3) Presence of acid-fast bacilli (AFB) in scrapings of skin lesions and/or biopsies. Early and diagnosis of leprosy is crucial to prevent permanent damage and further complications [15-17].

Clinical presentation of Leprosy varies, our case presented as indurated erythematous plaques which leads to many differential diagnoses as Tumid LE, Granuloma annulare, lupus panniculitis and scleroderma. Granuloma annulare is histologically characterized by degenerated collagen fibres, interstitial histiocytic collection, and deposition of mucin. Granuloma annulare can present in different histopathological patterns such as interstitial (57.9%), palisaded granuloma (26.3%), sarcoidal granuloma, and mixed [18].

Alcian blue done for mucin was found to be negative, which ruled out the possibilities of Granuloma annulare and Tumid LE. Lymphocytic infiltration around adipocytes were made out, but there was no fat necrosis which ruled out the possibility of Lupus Panniculitis.

Hence we proceeded with AFS and Fite farraco stain which stained the acid fast bacilli as pink. 10-100 bacilli seen in every field giving an bacteriological index of 4+.Due to the presence of grenz zone with multiple granulomas and an bacteriological index of 4+, we concluded this case as Borderline lepromatous leprosy.

Leprosy possess major discrepancy between the clinical findings and histopathological picture due to its varying clinical presentations, especially in Borderline lepromatous leprosy type. This is due to the immune response and the immunological status of the Individual [6].

Conclusion

The correlation of clinical and histopathological features is essential for diagnosis [1]. Due to its wide variation in clinical presentation, all suspected cases should be carefully evaluated for leprosy to prevent misdiagnosis. Histopathology plays a major role in establishing an accurate diagnosis. Both, common as well as uncommon clinical presentations should be kept in mind to avoid untoward delay in diagnosis [6].

Statements and Declarations

Conflicts of interest

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LETTER TO THE EDITOR

New Criminal Laws Fail to Address Issues About Unnatural Death Investigations: A Matter of Concern

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Dear Editor,

The introduction of new criminal laws (*Bharatiya Nyaya Sanhita, Bharatiya Nagarik Suraksha Sanhita, and the Bharatiya Sakshya Adhiniyam*) in India from July 1, 2024, is being hailed as a watershed moment by political analysts and legal experts in our country. However, as forensic pathologists who conducts medico-legal autopsies daily, we can attest that little has changed in the realm of death investigations. We still follow the colonial-era police and magisterial inquest methods for unnatural death investigations in this country.

The provisions under Sections 174 and 176 of the CrPC have been carried forward with minor modifications in Sections 194 and 196 BNSS. For instance, in subsection (2) of Section 194, the word “forthwith” has been replaced by “within twenty-four hours” for sending the report to the DM and SDM, and the term “man” has been replaced by “person.” Similarly, in Section 196 BNSS, the words "Judicial Magistrate" have been replaced by "Magistrate," and the Metropolitan Magistrate is excluded. These changes are superficial and fail to address the core issues being faced by the Forensic Medicine specialists and the larger public in India [1].

The 18th Law Commission of India, headed by Justice A.R. Lakshmanan, recommended the introduction of a Coroners Act applicable to the whole of India, way back in 2008, but this advice was not heeded to during the recent criminal law reforms. It is crucial to understand that ‘crime investigation’ and ‘death investigation’ are not synonymous as often perceived by a lot of people. Entrusting the responsibility of conducting inquests into unnatural deaths to police and magistrates,

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who often lack specialized training in death investigations, undermines the scientific approach needed to determine the cause of death and can lead to a miscarriage of justice [2]. In our practice, we have frequently observed that police officers and executive magistrates, who often conduct inquests in our country, sometimes lack the technical expertise required to collect all necessary materials to solve cases effectively or to approach the death investigation process with scientific rigor.

Historically, a coroner was an officer appointed by the king to investigate causes of death. Today, the coroner system is practiced in countries like Australia, the UK, Canada, some states of the USA, and several other nations like Japan as well. A coroner can be a lawyer, a doctor, or both, holding the rank of a first-class judicial magistrate and generally employs the services of forensic pathologists for medico legal postmortems. It is to be explicitly clarified that a coroner doesn't conduct postmortem examinations in general. They are appointed by the state government to inquire into the cause of death. The major advantage of the coroner system lies in its autonomy, access to power, and ability to represent the will of the people/electorate. As an elected/state nominated official, a coroner has the authority to make independent decisions and stands on equal footing with other local elected/nominated/appointed officials. This position enables coroners to withstand political pressures imposed by other elected/nominated/appointed officials and to compete vigorously for budget allocations. Furthermore, coroners possess subpoena and inquest powers, enhancing their capacity to conduct thorough and unbiased death investigations [3]. However, most countries are transitioning from the coroner inquest system to the medical examiner model.

The medical examiner system, widely adopted in Western countries, needs to be considered for unnatural death investigations where both the *'cause' and 'manner'* of death are often determined by the medical examiner. It is an undisputable fact that, ascertaining the 'manner of death' is a cardinal objective of a medico-legal autopsy and it would be appropriate that the autopsy surgeon and not the 'police' or 'magistrate' or 'coroner' decides the 'manner of death' (In Indian setup, fixing the 'manner of death' is usually considered as police business). Unlike the coroner system, the medical examiner system employs physicians, usually forensic pathologists, who have specialized training in death investigation at every step, ensuring a more scientific and precise determination of cause and manner of death. The medical examiner assesses the scene of the crime and has the authority to retain any samples or the entire body for investigation/ancillary investigations, as necessary. The medical examiner's office is also equipped with inhouse analytical toxicology, histopathology and molecular biology laboratories for all ancillary investigations required as part of autopsy. This is extremely helpful in timely transfer and analysis of samples and reduces the turnaround time in *cause of death* certification. In some jurisdictions across the globe, the medical examiner also has a discretionary power to decide whether a full autopsy is required in an unnatural death, or a *cause of death* certificate can be issued without an autopsy.

The medical examiner system is considered better to other forms of death investigating methods owing to the fact that the Chief Medical Examiner's office

establishes uniform protocols and standard operating procedures for each, and every type of case dealt with a medico legal postmortem. It is also well known that board certified pathologists often follow a self-regulated code of professionalism and conduct that upholds transparency and integrity in their practice. Additionally, forensic pathologists have the freedom to invest time and resources in the investigation process and can more effectively secure state budgets compared to coroner systems. One more advantage of the medical examiner system is that the office of the chief medical examiner has the opportunity to make sure that high quality autopsy services are available in each and every part of their jurisdiction by allocating resources with prudence and equality as a cornerstone. Furthermore, it offers significant opportunities for research and development in the field of unnatural deaths, which is feasible only at high-end centres like the chief medical examiner's office, where sufficient workforce and resources are available [4].

Death investigation is a distinct branch of medicine laced with forensic science, blending principles of pathology, toxicology, histology, and criminalistics. It requires a thorough understanding of postmortem changes, injury patterns, and various pathophysiological processes. Professionals involved in death investigation must be adept at integrating medical findings with scene investigation, witness statements, and other forensic evidence to reconstruct the events leading to death [5].

Both the currently practiced police and magistrate inquests for unnatural death investigations in our country are not up to optimal standards. It is necessary to adopt more scientific and robust death investigation systems for unnatural deaths through genuine criminal law reform. Merely changing the names of acts while retaining their colonial content is akin to putting old wine in new bottles and does not constitute true progress. Implementing a modern death investigation framework, whether through a coroner system with medically trained coroners or a comprehensive medical examiner system, will enhance the accuracy and reliability of death investigations, thereby serving the interests of justice more effectively.

Moreover, the adoption of a medical examiner system where the doctor has a discretion to sign the *cause of death* certificate without autopsy reduces unnecessary medico legal postmortems being conducted in our country in hospital deaths where a Medical Certification of Cause of Death (MCCD) data is available. Not only the medical examiner system is highly independent, but it also fosters a true engagement with the community and ensures a humane approach in giving perfect closures to death investigations unlike the bossy approach of police or revenue authorities.

In the interest of justice, it is imperative that we push for substantive reforms in our death investigation processes, ensuring they are modern, scientific, and effective. India deserves a world class death investigating system which is a long overdue.

Statements and Declarations

Conflicts of interest

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CLINICAL IMAGE

Scrotal Hematoma Following Pelvic Fracture

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A 19-year-old male sustained a pelvic injury after falling from a terrace. He had a pubic diastasis with a fracture of the right pubic rami and bilateral sacroiliac subluxation (right greater than left) (Figure 1A, B, and C). This led to hypovolemic shock due to excessive pelvic bleeding and low hemoglobin (8.1 gm/dl). After stabilizing medically, he underwent pelvic external fixation. Three hours later, he developed swelling and black discoloration of the scrotum and penis. Ultrasonography revealed diffuse subcutaneous edema around the scrotum without testicular or urethral injury.

The scrotal hematoma was managed conservatively with ice packs and sacral support and resolved in three weeks. The pelvic injuries were subsequently managed surgically with open reduction and internal fixation, after five days of the initial injury.

Extravasation of blood in the scrotal area causes scrotal hematoma, a potential complication of pelvic fractures. It occurs when the fracture bleeding accumulates in the retroperitoneal space and dissects down through fascial planes to reach the scrotum [1]. This leads to swelling and discoloration in the scrotum and perineal area. Scrotal hematoma has also been reported after blunt trauma [2], excessive pressure on the perineal post of the fracture table during fracture fixation [3], and femoral artery puncture [4].

Scrotal hematoma can often be managed conservatively. In rare cases, hematoma drainage is required if it causes excessive pressure or compromises blood flow to the testicles [1]. Early diagnosis and treatment of scrotal hematoma are crucial to prevent complications like compartment syndrome and testicular damage (Figure 2).

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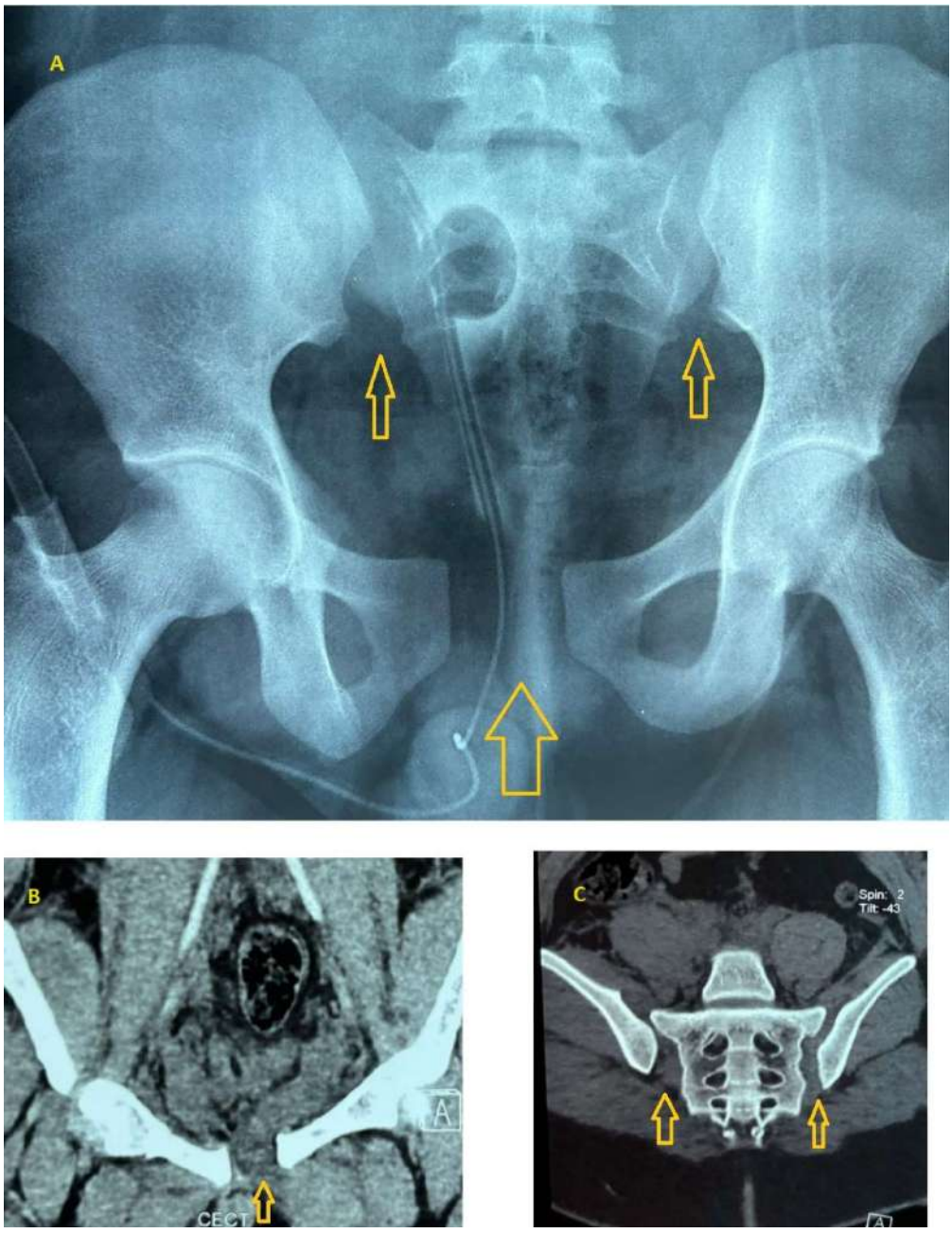

Figure 1 (A,B,C). Xray/CT showing pubic diastasis and SI joints subluxation

Figure 2. Swollen scrotum and penis with blackish discoloration

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Conflicts of interest

The authors declares that they do not have conflict of interest.

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Informed Consent

An informed consent of the patient was taken for publication of his case report, without disclosing his personal identity.

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