

Editorial

Medical Meetings

I write this sitting at home having just returned from a 3 day conference at Tata Medical Centre, Kolkata, on Recurrent Head and Neck Cancer. This is the seventh medical meeting I have attended since October. The full list reads as follows :

1. 21st ASEAN ENT Congress, Siem Reap, Cambodia (October 10th to 12th)
2. 26th Annual conference Skull Base Surgery Society of India, Chennai (October 30th and November 1st)
3. 25th Annual conference, Foundation for Head and Neck Oncology, Bengaluru (November 7th to 9th)
4. 2nd Annual meet, Endoscopic Transorbital Society/32nd Annual Scientific Meeting Hong Kong Neurosurgical Society, Hong Kong (November 14th to 16th)
5. 37th Annual Scientific Conference, Ramakrishna Mission Seva Pratishthan (November 21st and 22nd)
6. 36th Annual conference, All India Rhinology Society, Chennai (November 28th to 30th)
7. CME Program on Recurrent Head and Neck Cancer, Tata Medical Centre, Kolkata (December 5th to 7th)

With the exception of numbers 5 and 7 that was a lot of travelling, and with one exception all the expenses (registration, flights and accommodation) were borne by me. It is fairly easy to calculate the cost of attending these meetings, but how does one calculate the benefit? Is there really a benefit^[1], or have I just got in to an expensive habit?

A long time ago I personally resolved never to attend a medical meeting unless I was invited Faculty, or had an accepted presentation or poster. I both chaired a session and delivered an invited talk in Cambodia, had an oral presentation at the Skull Base meeting, chaired a session and had a poster at the Oncology meeting, was a judge and debater at our hospital meeting, had posters at the Rhinology meeting and was a panellist at the Tata CME. The Hong Kong meeting was more of a workshop.

How are these of benefit?^[2] To my mind there are numerous benefits from physically attending such meetings :

1. Presentations (both oral and poster) allow one to showcase the quality of work one is doing; selection/nomination as Faculty at a sub-specialist conference is a recognition of your standing amongst your peer group. In subspecialities such as Skull Base Surgery, where no NMC recognised super specialty training programme exists, this is an indirect validation of your knowledge and ability.
2. By choosing the meetings to match clinical and research interests one stays updated with the latest innovations in investigation and management, and can personally interact with the International and National experts in the field to clarify doubts and discuss ideas.
3. As a postgraduate teacher keeping abreast of the latest developments cross the entirety of ENT, by attending a general conference, is beneficial for teaching the residents; listening to oral presentations and reading posters of residents

from across the country can generate ideas for postgraduate theses or research projects.

4. The trade exhibition often features latest model equipment, and surgical instruments are available at a conference discount.

5. With the modern emphasis on avoiding physician burnout, attending a conference allows a few days break from routine work in a pleasant atmosphere.

During the COVID 19 lockdowns, with many meetings being held in the form of webinars utilising platforms such as Zoom, Microsoft Teams and Google meet, there were several voices advocating a complete ending to face-to-face conferences^[3]. The idea is attractive – large conferences are expensive and can generate a significant carbon footprint. A virtual meeting is cheaper to organise and attend (reducing dependence on pharmacology sponsorship), reduced travel is environmentally friendly, and less leave is required from work. However, post-COVID, it has become apparent that virtual meetings have their own hindrances. They are often scheduled late at night to avoid normal work; they require stable internet connections with a high data consumption, not always available; it is difficult to engage with the speakers or raise questions at appropriate times and delegates try and avoid taking leave, logging in

to sessions between work or while commuting – which is not conducive to attentive imbibing of knowledge. I will never forget the first virtual meeting I attended during the COVID 19 lockdown in 2020 – nearly all the 200 odd participants had their cameras on, and one ENT surgeon was taking a shower!!

Our Hospital Annual Scientific Conference is different. First, it is by nature a multispecialty affair, which has its own charms. The resident papers usually highlight good work or new facilities/ procedures available on campus, which is useful to know. Secondly, it has a distinct social dimension, from the competitive sports for the residents to the breakfasts, lunches and dinner, marking the only three days of the year when nearly all the attached doctors are on campus together. Thirdly there is a philosophical dimension embodied by the guest lectures by senior monks of the Ramakrishna Order. Finally, the recognition for long service accorded to the senior doctors promotes the sense of family, which is a hallmark of the Institution.

This issue will be the first to go online using the new Journal website. This is part of our efforts to acquire DOAJ indexing for the journal, which is recognised by the NMC. This should encourage all staff to contribute their original research papers for publication.

References :

1. Ionnidis JA. Are Medical Conferences useful? And for whom? 2012 JAMA 307(12), 1257-1258 doi:10.1001/jama.2012.360.
2. Hauss K. What are the social and scientific benefits of participating at academic conferences? Insights from a survey among doctoral students and postdocs in Germany. Research Evaluation, 2021 30 (1), 1-12 doi.org/10.1093/reseval/rvaa018.
3. Byrd N. Online Conferences: Some History, Methods, and Benefits. 2020 doi.org/10.7939/r3-q6mq-0004.

Guest Editorial

The Surrogacy Act Simplified

Sohini Chaudhury¹ Sukanta Misra²

Abstract :

The Surrogacy (Regulation) Act, 2021, marks a pivotal moment in India's journey towards regulating assisted reproductive technology (ART). The Act's primary aim is to safeguard both the surrogate mother and the intended parents, providing a clear legal framework to ensure ethical practices in surrogacy. This article explores the key provisions of the Act, the amendments made subsequently in the following years and the ethical, societal, and legal challenges that continue to shape the debate around surrogacy in India.

Introduction :

Surrogacy is a method of assisted reproduction where a woman (called a surrogate) agrees to carry and give birth to a baby for another person or couple (called the intended parent(s)). After birth, the baby is handed over to the intended parents, who become the child's legal guardians.

There are two main types of surrogacy :

1. Traditional Surrogacy :

The surrogate uses her own egg, making her the biological mother. Sperm from the intended father or a donor is used for fertilization, usually via artificial insemination. This method is less commonly used today due to legal and emotional complexities.

2. Gestational Surrogacy :

The surrogate has no genetic link to the baby.

An embryo is created via in vitro fertilization (IVF) using :

The egg and sperm from the intended parents, or Donor egg and/or donor sperm.

The embryo is then implanted into the surrogate's uterus.

Why People Choose Surrogacy :

Surrogacy has gained global prominence and there is increased need for surrogacy over the past couple of decades. It is driven by several medical, social, and demographic factors.

1. Rising Infertility Rates

Delayed childbearing : More people are choosing to have children later in life, often in their late 30s or 40s, when fertility naturally declines.

Medical issues : Conditions like PCOS, endometriosis, cancer treatments (e.g., chemotherapy), or uterine abnormalities can make pregnancy difficult or unsafe.

Male infertility : Sperm quality has been declining globally, contributing to fertility challenges.

2. LGBTQ+ Family Building

Same-sex male couples and single men increasingly use surrogacy to have biological children.

Legal recognition and growing social acceptance of LGBTQ+ parenting have made surrogacy a more viable and visible option.

3. Women with Medical Conditions or Uterine Issues

¹Assistant Professor, ²Professor — Department of Obstetrics & Gynaecology, RKMSP

Some women are unable to safely carry a pregnancy due to health issues like:

- * Heart disease
- * Recurrent miscarriage

Absence of a uterus (e.g., congenital or after hysterectomy)

Surrogacy provides a way to have a biological child without endangering the mother's life.

4. Technological Advances in Reproductive Medicine

Improvements in IVF success rates, egg/sperm freezing, and genetic testing have made surrogacy more effective and accessible.

These advances give more people confidence in using assisted reproductive techniques.

5. Globalization and Legal Changes

Some countries and states have legalized or better regulated surrogacy, making it easier for people to pursue it.

Cross-border surrogacy is common, especially where local laws are restrictive or where costs are lower abroad.

6. Awareness and Acceptance

Increased media coverage, celebrity cases, and advocacy have reduced stigma and increased awareness of surrogacy as a legitimate path to parenthood.

However, due to lack of regulation in India, a major hub for surrogacy has raised concerns about exploitation, particularly of surrogate mothers. The Surrogacy (Regulation) Act, 2021, seeks to address these concerns by offering a legal framework for surrogacy practices, emphasizing ethical standards and the well-being of all involved. Although the Act has been lauded

for its intent to protect vulnerable individuals, it has also faced criticism and calls for amendments to ensure broader inclusivity and fairness.

Key Provisions of the Surrogacy (Regulation) Act, 2021 :

The Act lays out the following core provisions aimed at protecting both surrogate mothers and intended parents :

1. Altruistic Surrogacy :

The Act permits only altruistic surrogacy and commercial surrogacy is prohibited, which means that surrogate mothers are compensated solely for medical expenses and insurance, with no profit-making allowed. This ban on commercial surrogacy aims to reduce the risk of exploitation through sale, production or prostitution.

2. Governance and Regulation :

The Act establishes a National Surrogacy Board and State Surrogacy Boards to oversee registered surrogacy clinics, ensuring they operate according to ethical standards. These bodies are tasked with ensuring proper registration and inspections of all clinics, with a focus on transparency and accountability.

3. Eligibility Criteria for Intended :

Parents/Woman : Intended parents must be Indian citizens/Overseas Citizens of India (OCI) cardholders and are generally permitted to pursue altruistic surrogacy under specific conditions, but commercial surrogacy is prohibited++.

- a) Married couple between the age of 23 to 50 years in case of female and between

- 26 to 55 years in case of male, not having any surviving child biologically or through adoption or through surrogacy earlier; except for a child who is mentally or physically challenged or suffers from life threatening disorder etc, approved by the appropriate authority with due medical certificate (certificate of eligibility) from a District Medical Board.

Having a certificate (certificate of essentiality) of proven infertility of one or both members of the intending couple by a District Medical Board and Parentage order passed by First Class Magistrate.

4. Eligibility Criteria for Surrogate Mothers:

A willing woman between the age of 25 and 35, having a certificate of medical and psychological fitness for surrogacy and surrogacy procedures from a registered medical practitioner; married with at least one biological child, and must act as surrogate only once in her lifetime. The surrogacy arrangement can only take place if the surrogate is a close relative of the intended parents and is not supposed to donate her gamete for the purpose.

5. Rights of the surrogate :

- a) Written informed consent of surrogate mother by explaining all known side effects and after effects of such procedures and obtained in the prescribed form, in the language she understands.
- b) The surrogate mother shall have an option to withdraw her consent for surrogacy before the implantation of human embryo in her womb.
- c) An insurance coverage of such amount

and in such manner as may be prescribed in favour of the surrogate mother for a period of thirty-six months covering postpartum delivery complications from an insurance company or an agent recognised by the Insurance Regulatory and Development Authority established under the Insurance Regulatory and Development Authority Act, 1999 (41 of 1999);

6. Prohibition to abandon child born through surrogacy :

The intending couple or intending woman shall not abandon the child, born out of a surrogacy procedure, whether within India or outside, for any reason whatsoever, including but not restricted to, any genetic defect, birth defect, any other medical condition, the defects developing subsequently, sex of the child or conception of more than one baby and the like.

7. Rights of surrogate child :

A child born out of surrogacy procedure, shall be deemed to be a biological child of the intending couple or intending woman and the said child shall be entitled to all the rights and privileges available to a natural child under any law for time being in force

8. Number of oocytes or human embryos to be implanted :

The number of oocytes or human embryos to be implanted in the uterus of the surrogate mother for the purpose of surrogacy, shall be such as may be prescribed.

9. Prohibition of abortion :

No person, organisation, surrogacy clinic, laboratory or clinical establishment of any

kind shall force the surrogate mother to abort at any stage of surrogacy except in such conditions as may be prescribed.

Amendments to the Act (2023, 2024, and beyond) :

In response to criticisms and the evolving needs of assisted reproductive technologies, the Indian government introduced significant amendments to the Surrogacy (Regulation) Act in 2023 and 2024. These amendments were aimed at making the law more inclusive and practical, addressing gaps and loopholes in the original provisions.

Expansion of 'Close Relative' Definition (2023 Amendment) :

Initially, the Act only allowed direct family members like siblings and parents to act as surrogates. However, following the 2023 amendment, the definition of a "close relative" has been expanded to include extended family members such as cousins, aunts, and uncles. This change was made to increase the pool of potential surrogates and provide more options for intended parents.

Allowing Surrogacy for Single Women (2023 Amendment) :

One of the most significant changes in the 2023 amendment was the extension of surrogacy rights to single women, particularly widows and divorced women aged 35–45. Prior to this, the Act excluded single women from surrogacy arrangements. With this amendment, single women can now pursue surrogacy as a reproductive option, provided there is a 'genetic link' ie using her own gamete.

Inclusion of donor gametes (sperm/egg) in surrogacy arrangements (2024 Amendment):

An amendment to Surrogacy (Regulation) Rules

2022 in March 2023 prohibited the use of donor gametes and required both the male and female gamete must come from the intending couple.

In October 2023, Supreme Court in the Arun Muthuvel vs. Union of India case allowed a woman with Mayer-Rokitansky-Kuster-Hauser (MRKH) Syndrome to undergo surrogacy with a donor egg. The 2024 Amendment to Surrogacy (Regulation) Rules, 2022 allow surrogacy using a donor gamete. Benefits of this provision could be availed if District Medical Board certifies that either of the intending couples suffers from a medical condition necessitating the use of a donor gamete.

Commercial Surrogacy Penalties (2024 Amendment) :

The 2024 amendment strengthens the penalties for those involved in commercial surrogacy. Those found guilty of promoting or participating in commercial surrogacy now face harsher penalties, including up to 10 years in prison and a Rs.10 lakh fine. This amendment aims to deter illegal commercial surrogacy operations and protect vulnerable women from exploitation.

Ethical and Societal Considerations :

Despite the legal safeguards introduced by the Act and its amendments, ethical issues remain at the forefront of the surrogacy debate. Critics argue that the altruistic model may limit access to surrogacy for many couples who cannot find a willing surrogate mother in their immediate family, thus restricting their reproductive choices. Additionally, concerns about the autonomy of women involved in surrogacy persist, especially regarding whether women may be coerced into becoming surrogates due to financial or social pressures.

Furthermore, the exclusion of LGBTQ+ couples

and single men from surrogacy arrangements has led to debates about the inclusivity of the law. The question remains whether the Act's restrictions are justified or whether they unfairly discriminate against these groups.

The Road Ahead :

While the Surrogacy (Regulation) Act, 2021, along with its amendments, is a step towards a more regulated and ethical surrogacy practice in India, there are ongoing concerns about the balance between regulation and accessibility. The amendments, particularly those made in 2023, 2024, and February 2024, aim to make surrogacy more inclusive and to regulate international surrogacy more effectively. However, the law's restrictive provisions,

especially regarding LGBTQ+ couples, may still hinder its full acceptance and implementation.

Conclusion :

The Surrogacy (Regulation) Act, 2021, along with its amendments in 2023, 2024, and the February 2024 update on donor gametes, is a significant milestone in India's journey toward regulating assisted reproductive technology. While it has made important strides in ensuring ethical surrogacy practices, questions about access, inclusivity, and the autonomy of women remain. For the Act to be truly effective, it will need to continue evolving to address emerging challenges while balancing the rights of all parties involved.

Guest Editorial

Decision Making in Medicine

Sudip Chatterjee

Decision making in medicine is extremely complex and very hard to describe as a process. Often decisions to do nothing are more complex than decisions to actually do something. So how does one go about decision making as a clinician?

1. The problem has to be identified. For example we know atrial septal defect (ASD) is common and should be identified early in life. A fixed split second heart sound often suggests ASD. On the other hand, many children can have a split second sound without any problems whatsoever. Let's now hypothetically go to a nursery school and check out the heart sounds of the children there. We find 10% have a split second heart sound. It's very unlikely that these children will actually have an ASD. On the other hand if we go to the waiting room of a Pediatric Cardiology OPD and find 10% of the children *there* have a split second sound, it is likely that most of them will have ASD. The phenomenon can be quantified in the Bayes' Theorem which I'll talk about later.

2. The accuracy of our diagnosis depends on the accuracy of the test and also on how common the disease itself is. This concept can be used in many situations. For example if we wish to pick up active TB patients in the community, we can do a Mantoux Test. The test will not miss any person with TB but will pick up lots of persons who don't have TB. It is hence a sensitive test. We can if we wish, select a test like checking the sputum for AFB. The positive persons will definitely have TB but we will miss some sputum negative patients who also have TB. It is hence

a specific test.

3. Of course before we go about decision making we must get adequate information. The most important characteristic that differentiates an experienced clinician from a novice is in the history they take. The history is the most relevant and focused piece of information. As for physical findings, more or less the same finding will be elicited by nearly all physicians. When we come to investigations, the experienced physician is likely to order far fewer tests than the trainee. Sometimes the Google enriched patient comes into the picture and asks for yet more tests.

4. After the information is in, we list all possible problems that the patient can have. May be more tests will be needed to confirm or refute the diagnoses. At times diagnosis and treatment are done together as in emergencies, like acute myocardial infarction.

5. Many subjective factors influence decision making. For example a healthy young adult with an Hb A1c of 8% will be counselled to reduce it to below 7%. However the same HbA1c in an 85 year old who has already had a stroke and MI would be perfectly acceptable. This depends on the clinician's knowledge and risk tolerance of patient and physician.

An individual who is worried and anxious because of chest pain may prompt the clinician to ask for a coronary angiogram although the process is not without risk and certainly carries a cost. Here the patient's risk intolerance drives decision making. A patient with a lump in the abdomen may come and say 'I a'm 90 years old

I don't care what's there. Please do nothing more than an ultrasound'. Here the risk tolerant patient's views drive decision making and the clinician accepts the risk of leaving the lump untreated.

6. Myriad ethical issues surround decision making; for example, whether to ventilate a patient or not. Here the person most closely involved i.e. the patient himself cannot contribute. Advance directives can be overridden by family members. There can be conflict within a family regarding the policy and costs. The hapless physician is usually caught in the middle. The health care system may or may not tolerate certain practices. For example, a cancer patient may need expensive biologicals which are not covered by many insurance plans. This 'non-coverage' is a new addition to existing plans but limits our medical choices for economic reasons.

7. Often we face information overload. For example there are certain labs that actually measure serum beryllium, gold, vanadium silver and so on. The values of these mean absolutely nothing. Unfortunately any outlier value however trivial, that is in bold type's bolded in the report, can cause severe anxiety and frenzied web searching *and* is of zero value.

8. Often doctors rely on pattern recognition to diagnose. For example, when we identify a bird as a bulbul, we do so from our memory of seeing many similar bulbuls in the past. Similarly in an ECG we recognize patterns and come to conclusions by pattern recognition. This is a field where machine learning is of immense value. A properly programmed computer can accurately

read ECG's, CT scans, Pap smears, retinal photos and so on. The computer does not get tired and is faster and more accurate than doctors. The computer is totally dependent on the data it has been fed with. For example, while screening for diabetic retinopathy a fundus with retinoblastoma may come up. If the computer has not been taught to recognize this, it will pass it as normal. If a mistake happens, the question comes as to who will take the responsibility for the mistake. As of now, the legal framework for computerized diagnosis hasn't come up in India.

9. To come back to the Bayes' Theorem. The accuracy of a test like a mammogram to detect breast cancer depends on its incidence in the community. Let's assume the incidence among 50 yr old women is 1% and the mammogram has a specificity of 90% and a sensitivity of 90%. In the event of a positive result, the Bayes' Theorem states that she has a 8.3% chance of actually having breast cancer. If the incidence goes up to 10%, (say in a group of relatives of breast cancer patients) a positive result will confer a 50 % chance of breast cancer. To some of us, this may sound counter intuitive, but it is true.

10. To summarize : Diagnostic decision making can be intuitive, evidence based, analytical i.e. using algorithms and Bayesian. Cost effectiveness, ethical, legal and financial constraints, patient's views and our own competence strongly influence our decisions. In the end we must accept that we deal with uncertainties and not every decision we take can be right.

Reference :

Masic I. Medical Decision Making - an Overview. Acta Inform Med. 2022 Sep;30(3):230-235. doi:

10.5455/aim.2022.30.230-235. PMID: 36311160; PMCID: PMC9560052.

Original Article

Gastrointestinal Features as A Presenting Manifestation in Pediatric Rheumatology Patients

Moulik Pariya¹, Nisha Bhattacharyya (Ghiya)², Suparna Guha³

Abstract :

Objective : Rheumatic diseases in children are chronic and multisystemic diseases. In our study it was aimed to assess the prevalence of gastrointestinal manifestations as the initial presenting feature of underlying pediatric rheumatological disorders.

Methods :

This was a retrospective cross-sectional study. Data of consecutive patients enrolled in the pediatric rheumatology clinic (both outpatient & in-patient) was analysed. Those who had presented with predominant gastrointestinal manifestations were taken into consideration. Data regarding detailed history, clinical findings, laboratory results and therapy offered, was recorded.

Results :

Among total number of 90 patients, 10 patients who presented with gastrointestinal manifestations were included in this study. In all the 10 patients underlying autoimmune pathology was detected. 6 of them turned out to be systemic lupus erythematosus (SLE), 2 Henoch schonlein purpura (HSP), 1 Mixed connective tissue disorder (MCTD), 1 Systemic juvenile idiopathic arthritis (SJIA). Among the SLE patients 2 presented with autoimmune

hepatitis, 1 lupus hepatitis, 1 pancreatitis, 2 ascites. Two patients among them later developed extra gastrointestinal major system involvement in the form of lupus nephritis. Most common symptom at presentation was pain abdomen. In our study the 2 HSP patient presented with severe pain abdomen and bloody stools, rash developed later on. The sole MCTD patient presented with ascites. The SJIA patient presented with severe pain abdomen, later confirmed to be a case of SJIA presenting as Macrophage activation syndrome). Overall prevalence of gastrointestinal manifestations came as 11.11 percent in our study. All the patients responded to immune suppression.

Conclusion :

We should always keep in mind the possibility of underlying autoimmune pathology in patients presenting with gastrointestinal manifestations after ruling out the common causes.

Introduction :

Systemic autoimmune diseases can cause a wide array of gastrointestinal manifestations affecting any part of the digestive tract including the esophagus, stomach, liver, pancreas, large and small intestine thereby, giving rise to symptoms like dysphagia, abdominal pain, diarrhoea, oral ulcer, bleeding, nausea and vomiting. Studies

¹Junior Resident, ²Assistant Professor, ³Professor, — Department of Paediatrics, RKMS

show that about 20 percent patients of SLE may have gastrointestinal manifestations at the onset of disease^[1]; 90 percent of systemic sclerosis patients have gastrointestinal features^[2]. However sometimes in patients presenting with gastrointestinal manifestations, the background autoimmune pathology is quite often missed and detected much later. This not only creates a diagnostic dilemma but also delays the initiation of appropriate immune suppression. Early recognition and comprehensive treatment with immunosuppressive drugs can lead to reversal of symptoms and thereby improving the outcome. In this article we will discuss a series of cases which actually presented with predominant gastrointestinal features and later on extensive work-up turned out to have a background autoimmune pathology.

Objective :

To assess the prevalence of gastrointestinal manifestations suggesting major GI organ involvement as the initial presenting feature of underlying pediatric rheumatological disorders.

Materials and Methods :

This is a retrospective cross-sectional study. Data was collected from history sheets of patients attending pediatric rheumatology clinic of RKMS & VIMS from 1st April 2023 to 30th September 2024). Data collected from the outpatient and inpatient records included demographic features, history, clinical findings laboratory reports treatment given and outcome.

Result :

Out of 90 patients (among which 50 were JIA,

20 SLE, 5 JDM, 5 MCTD, 10 HSP) 10 presented with predominant gastrointestinal features.

- Among 10 patients 2 were male 8 female. Mean age of presentation was 9 years. These 10 patients were in the long run diagnosed with rheumatological disorders namely SLE in 6, HSP in 2, and 1 each with MCTD & SJIA.
- Majority of the patients (6 out of 10) also had history of prolonged fever along with GI problems. The most common GI complaint was pain abdomen and vomiting.
- Of the 6 SLE patients 3 also had hepatitis (2 were autoimmune and 1 had lupus hepatitis), 1 patient had pancreatitis, other 2 with ascites. Out of these 6 patients, 2 later developed extra intestinal major organ involvement in the form of nephritis.
- The lone patient with MCTD presented with ascites.
- 2 patients of HSP presented with severe pain abdomen and bloody stools, palpable purpura developed later during the course of hospital stay.
- The sole patient of SJIA presented with severe pain abdomen, as a manifestation of macrophage activation syndrome (MAS).
- Prevalence of GI manifestations in our series, turned out to be 11.11 percent.

All the patients responded to immunosuppressive therapy in the form of glucocorticoids, hydroxychloroquine (HCQ), azathioprine (AZR) and Mycophenolate mofetil (MMF).

Pat.	Gen.	Age	Presenting GI Features	Blood inv.	Other inv.	Diagnosis	Extra-intestinal involvement	Treatment
1	F	11y	Pain abdomen Hepatosplenomegaly	Pancytopenia (Hb 7.7g/dl TLC 2800/ cmm, PLT 1.2L/cmm) Transaminitis (SGOT 272U/L SGPT 123U/L), ANA (anti nuclear antibody) 1:640+ (IIF, HepII), ENA- Anti ds DNA++ Anti Histone, & Anti Nucleosome+, AMA M2 (Anti mitochondrial antibody, M2 subtype)+ AntiLKM (Anti liver kidney microsomal antibody)+	UGI endoscopy: gastric erythema, duodenal erosions USG abdomen Hepatosplenomegaly	SLE with autoimmune hepatitis	Class IIIA Lupus nephritis	Pulse methyl prednisolone, oralsteroid, Hydroxy chloroquine (HCQ), MMF
2	F	8y	Pain abdomen Hepatosplenomegaly	Amylase>10000U/L & Lipase>6000U/L Pancytopenia (Hb 6.7g/dl, TLC 2200/cmm LT20000/cmm) ANA: 1:640(IIF, HepII) AntidsDNA+	CECT Abdomen- bulky edematous pancreas with peripancreatic edema	SLE with pancreatitis		Pulse methyl prednisolone, oral steroid, Cyclophosphamide, MMF, AZR
3	M	10y	Ascites	Hb 8.1g/dl, TLC 8300/cmm, PLT 1.4L/cmm ANA 1:160, Anti dsDNA+ LFT-ALB 2.3 g/dl, SGPT 100U/L, SGOT 90U/L	USG : ascites, pleural effusion.	SLE with serositis	Class IIIA lupus nephritis	Pulse methyl prednisolone, oral prednisolone, MMF
4	F	11y	Ascites	RF(Rheumatoid factor)+, ANA+ fine speckled pattern	USG abdomen- ascites	MCTD with ascites		Steroid, methotrexate
5	F	11y	Pain abdomen, Tender hepatomegaly.	Transaminitis (SGOT 153U/LSGPT 162 U/L) ANA 1:16 (Hep II, IIF), Antids DNA +	USG abdomen- hepatomegaly	SLE with hepatitis		HCQ, Prednisolone, AZR
6	F	11y	Recurrent vomiting, pain abdomen, jaundice.	Pancytopenia (Hb 9.7g/dl TC 4700/cmm, PLT- 1L/cmm) ASMA (Anti smooth muscle antibody)+ LKM + ANA + 1:640; Anti ds DNA+ Transaminitis (SGPT 146 U/LSGOT 365U/L)		SLE with autoimmune hepatitis		Steroids, AZR

Pat.	Gen.	Age	Presenting GI Features	Blood inv.	Other inv.	Diagnosis	Extra-intestinal involvement	Treatment
7	M	8y	Severe pain abdomen, blood in stool	Blood investigations normal	USG Abdomen-hepatosplenomegaly	HSP with ?GI vasculitis		Pulse methylprednisolone, oral steroid, AZR
8	F	6y	Severe pain abdomen, bloody stool	Blood investigations normal	USG Abdomen-Normal	HSP with? GI vasculitis		Pulse methylpred, oral prednisolone
			Massive Ascites with hepatosplenomegaly	ANA 1:640; .Anti dsDNA+ Cancer antigen 125(CA-125):356 U/L Alpha fetoprotein(AFP) and Carcinoembryonic antigen(CEA)-Normal	USG abdomen-hepatosplenomegaly, serositis	SLE with ?pseudopseudomeigs syndrome [as CA 125 elevated]		Methylprednisolone, oral steroid Methotrexate, HCQ
10	F	8y	Severe pain abdomen	Hb 7.5 g/dl TLC 15000/cumm;PLT 1.1lac/cmm, ESR-20 mm; CRP 322mg/L Ferritin 34402 ng/ml; LDH 1282U/L; TG 252mg/dl	USG Abdomen-Normal	SJIA presenting as MAS		Methylprednisolone, oral steroids cyclosporine, tocilizumab

Discussion :

In this study we evaluated the autoimmune diseases which actually had predominant Gastrointestinal manifestations as the presenting complaint. The most common feature was pain abdomen. Fever was present in majority of the patients.

Of the 90 patients which were included in the study, only 10 (11%) had predominant GI involvement at the time of diagnosis. This is in tune with a study conducted by Altay et al^[3] where the prevalence was GI manifestations in pediatric autoimmune diseases was almost 7.5%.

The most common pediatric vasculitis is IgA vasculitis^[4], gastrointestinal manifestations occur

in about 50-75 percent cases of which 10-15 percent may precede rash^[5]. In our series out of 10 cases of IgAV2 presented with pain abdomen and GI bleed. Both had acute presentation and had to be pulsed with methyl prednisolone (10-15 mg/kg/d) for 3 days followed by tapering doses of oral steroids. Similar case reports of IgA vasculitis presenting with GI manifestations, preceding skin rash have also been reported^[4]. Previous Studies^[1] have shown that in SLE gastrointestinal findings may be seen in 20 percent of the patients with pain abdomen being the most common presenting complaint.

Gastrointestinal manifestations in SLE may be in the form of mesenteric vasculitis, protein losing enteropathy, intestinal pseudo-obstruction,

coeliac disease, pancreatitis and hepatitis^[6]. Hepatitis in SLE may be autoimmune, drug induced or due to inflammation as a result of SLE itself^[6]. In our series out of 20 SLE patients, 2 had autoimmune hepatitis. Tahernia et al. evaluated the frequency and type of hepatic involvement in 138 children with SLE. About 50 percent patients showed hepatic involvement^[6]. In the same study, pancreatitis was seen in 0.7 to 4 percent of cases^[6]. One case of SLE presented with severe serositis and had very high levels of CA-125 in the absence of any malignancy. This entity is coined as Pseudo-pseudo Meigs syndrome^[7]. Only very few cases have been reported worldwide and to our knowledge, as per literature search, this is the youngest case reported so far.

GI involvement in JIA may occur in the form of non-specific eosinophilic intestinal mucosal inflammation^[8]. In our series only 1 patient presented with severe pain abdomen. Actually this child had a prolonged H/O fever with a rash initially and very high inflammatory markers. She was on prolonged repeated courses of antibiotics. A few days prior to admission in our hospital she developed severe pain abdomen and vomiting. Extensive work up revealed evidence

of Macrophage activation syndrome. In the background of prolonged fever with rash a diagnosis of SJIA was made. The pain abdomen was actually a manifestation of MAS. MAS is a cytokine storm causing multi-system inflammation and pain abdomen may be often be the presenting feature^[9].

In this study, though the common presenting feature was pain abdomen, the GI involvement had a heterogeneous pattern in the form of hepatitis, pancreatitis, and ascites. Our study had certain limitations. Firstly, it was a retrospective study and obtaining medical information about the patients was difficult. Second, due to the small number of cases, evaluation of GI findings in autoimmune disease was difficult.

Conclusion :

Thus we can conclude that, we should always keep in mind the possibility of underlying autoimmune pathology in patients presenting with gastrointestinal manifestations after ruling out the common causes. All the patients who presented to us in rheumatology clinic with gastrointestinal manifestations ultimately were proven to have an autoimmune disease.

References :

1. Shukri N, Mohamad W, Rahaman W. Childhood onset systemic lupus erythematosus presenting with concomitant gastrointestinal manifestation and antiphospholipid syndrome. *Cureus*. 2023 Nov.
2. Kröner PTM, Tolaymat OA, Bowman AW, Abril A, Lacy BE. Gastrointestinal manifestations of rheumatological diseases. *Am J Gastroenterol*. 2019 Sep;114(9):1441–1454.
3. Altay D, Paç Kisaarslan A, Arslan D. Gastrointestinal endoscopic findings of autoimmune and autoinflammatory diseases in pediatric rheumatology patients. *North Clin Istanbul*. 2023;10(2):228–236.
4. Oni L, Sampath S. Childhood IgA vasculitis (Henoch–Schönlein purpura): advances and knowledge gaps. *Front Pediatr*. 2019 Jun 27;7:257. doi:10.3389/fped.2019.00257. PMID:31316952; PMCID:PMC6610473.
5. Cojocariu C, Singep A, Chiriac S, Stanciu C, et al. Gastrointestinal manifestations of IgA vasculitis (Henoch–Schönlein purpura). In: *IntechOpen*; 2019 Jun. doi:10.5772/intechopen.86966.
6. Mauro A, Giani T, Di Nardo G, et al. Gastrointestinal involvement in children with systemic lupus erythematosus. *Children*. 2023 Feb.

7. Man BL, Mok CC. Serositis related to systemic lupus erythematosus: prevalence and outcome. *Lupus*. 2005;14(10). doi:10.1191/0961203305lu2187oa.
8. Pichler J, Ong C, Shah N, Sebire N, Kiparrissi F, Borrelli O, Pilkington C, Elawad M. Histopathological features of gastrointestinal mucosal biopsies in children with juvenile idiopathic arthritis. *Pediatr Res*. 2016 Jun;79(6):895–901. doi:10.1038/pr.2016.27. Epub 2016 Feb 16. PMID:26882369.
9. Alkoht A, Hanafi I, Khalil B. Macrophage activation syndrome: a report of two cases and a literature review. *Case Rep Rheumatol*. 2017;2017:5304180. doi:10.1155/2017/5304180. Epub 2017 Oct 25. PMID:29209549; PMCID:PMC5676417.

List of abbreviations :

Pat. : Patient no,

Gen. : Gender

Inv. : Investigations

Hb : Hemoglobin

TLC : Total leucocyte count

MAS : Macrophage activation syndrome

LFT : Liver function test

PLT : Platelets

CRP : C reactive protein

ESR : Erythrocyte sedimentation rate

HSP : Henoch schonlein purpura

MCTD : Mixed connective tissue disorder.

SLE : Systemic lupus erythematosus

SJIA : Systemic juvenile idiopathic arthritis.

AZR : Azathioprine

ALB : Albumin

ANA : Anti nuclear antibody

AMA : Anti mitochondrial antibody

Anti LKM : Anti liver kidney microsomal antibody.

CEA : Carcinoembryonic antigen

AFP : Alpha fetoprotein

CA 125 : Cancer antigen 125

MMF : Mycophenolate mofetil

HCQ : Hydroxychloroquine.

Original Article

Limberg Transposition Flap in Treatment of Sacro-coccygeal Pilonidal Sinus : A Series of 14 Cases

Debayan Chowdhury¹, Kalyan Ashis Mukherjee²

Abstract :**Background:**

Sacro-coccygeal pilonidal sinus is a condition most commonly seen among young adult male population. There are several treatment options, mainstay being surgery. Conventional surgical method of simple excision of the sinus with midline primary closure results in high rates of recurrences, so discontinued. Thus, flap reconstruction is preferred.

Materials and Methods :

Study design: A case series – a prospective, longitudinal, interventional study. Study period: March 2019 to February 2024 (5 years). Sample Size: 14 cases. Methodology: Limberg Transposition Flap was done in all 14 cases. They were discharged from the hospital with drain in-situ which was removed on following visits once collection was <10 ml in 24 hours. They were followed up for 6-12 months.

Results :

21.4% (n=3) patients presented with multiple tracts whereas 78.6% (n=11) patients presented with single sinus tract in the sacrococcygeal region. There was no case of Wound Infection or Flap Necrosis. 14.28% (n=2) patients had cut through of sutures. The Mean Post-Operative Stay (Mean $\pm$ s.d.) (Days) was 5.43 ± 0.938 . The Mean Post-Operative Day of Drain Removal (Mean $\pm$ s.d.) (Days) was 19.36 ± 2.170 . The Mean Number of Days to Return to Normal

Activity (Mean $\pm$ s.d.) (Days) was 23.36 ± 2.205 . There were no Recurrences.

Conclusion :

Limberg Transposition Flap is an effective surgical procedure to treat patients with pilonidal sinus disease. By this flap, we can escape scarring in the midline. This is cosmetically good, and there have been no cases of recurrence in our study.

Keywords :

PNS = Pilonidal sinus, SC-PSD = Sacrococcygeal pilonidal sinus disease

Introduction :

A pilonidal sinus (PNS) is a small passageway beneath the skin that is commonly present in the sacrococcygeal region^[1]. SC-PSD is an acquired condition usually seen in young adults especially males^[2]. Damaged hair follicles and imprisoned hair are thought to be the cause, leading to folliculitis, infection, and rupture into the surrounding subcutaneous tissue leading to a painful, persistent condition^[1].

The pilonidal disease was once assumed to be a congenital ailment produced by aberrant skin in the gluteal cleft, but it is now thought to be an acquired syndrome caused by hair in the cleft. The hair triggers an inflammatory response, resulting in persistent sinus and tract drainage, as well as secondary infection and abscess formation^[3]. Causes are by local trauma, poor hygiene, extreme hairiness, or the existence of

¹Assistant Professor, ²Associate Professor — Department of General Surgery, RKMS

a deep natal cleft. This is a benign condition acquired most likely by males, young age group, overweight, and hirsute individuals, as well as those with a positive family history^[4].

There is a visible external opening or pit in the midline of natal cleft. The expansion is induced by the stretching of the follicular openings caused by gravity pulling on the buttocks. Sweating excessively might also lead to the development of PNS. Moisture can fill a stretched hair follicle, creating a low oxygen environment that encourages anaerobic bacterial growth. Bacterial growth and low oxygen levels impede wound healing and hasten the formation of the PNS^[5].

PNS disease can be asymptomatic, acute, chronic, or recurrent. The common presenting symptoms are pain (84%), discharge (78%), and localized edema^[6]. A thorough clinical examination, history taking, and radiological investigations like MRI may be necessary for diagnosis and delineation of the tract^[7].

The main concern for SCC-PSD treatment is the recurrence; the literature review shows that it ranges from 20–40% regardless of the technique used^[8]. Many reasons were attributed to recurrence, such as leaving behind some tracts, sutures in midline causing more trauma with repeated infection accumulation of perspiration, and friction with tendency of the hair getting incorporated into the wound^[9].

Several surgical options have been explained in literature for treatment of SC-PSD. Limberg rhomboid flap for sacrococcygeal pilonidal sinus was designed by Limberg in 1946, who described a technique for closing a 60° rhombus-shaped defect with a transposition flap^[10]. This

prospective study has been performed to determine effects of the Limberg flap rotation surgery for sacrococcygeal pilonidal sinus, its feasibility to the patients, their compliance, and outcomes such as wound infection, postoperative pain relief, recurrence rates, and return to work.

Case Presentations :

Patients presented with pain, swelling or chronic discharging sinus from the intergluteal cleft. Swelling was due to small localised abscess arising from the sinus itself. Diagnosis of pilonidal sinus was clinical owing to their position in the sacro-coccygeal region.

Materials and Methods :

Study design : This is a case series – a prospective, longitudinal, interventional study.

Study area : Patients coming to OPD of Ramakrishna Mission Seva Pratishthan Hospital with pilonidal sinus.

Study period : March 2019 to February 2024 (5 years).

Sample Size : 14 cases.

Investigation : All patients were pre-operatively assessed with MRI (Magnetic Resonance Imaging) of the sacro-coccygeal region to delineate the tract/tracts or any foci of abscess.

Procedure Methodology :

Under spinal anaesthesia, the patient was put in prone position with buttocks strapped apart and surgical site exposed. External opening of the sinus noted. With a 20 Fr IV canula, Hydrogen peroxide and methylene blue was injected into the sinus tract.



Fig 1 : Injection of hydrogen peroxide and methylene blue via 20 Fr cannula into the tracts

Probing of the tract done with a metallic probe to identify the distal extent of the sinus tract. Multiple openings signified multiple sinus tracts which may be separate or interconnected. Each of the tracts were probed to delineate the exact anatomy and the distal extent of the tracts. Extent was determined by palpation of the tip of the probe after full insertion and marking of the overlying skin.

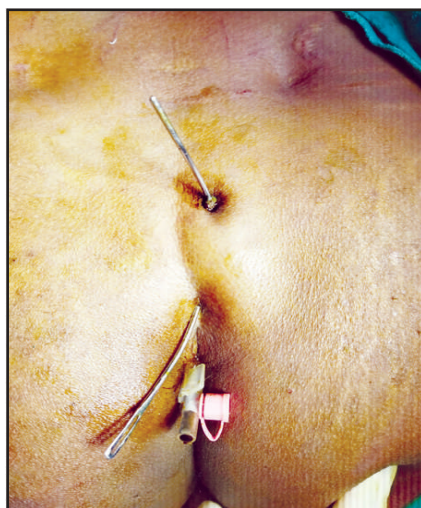


Fig 2: Probing of the tracts

Then, a rhomboid was marked over the skin with a skin-marking pen, taking all the external openings and the distal ends of the tracts within it (cranio-caudal or lateral extents).

The long axis of the rhomboid in the midline (Cranio-caudal) is marked A (above) and C (below). Point A lies beyond the distal extent of the tract. Point C lies in the gluteal cleft adjacent to the perianal skin. This, A-C is the cranio-caudal diagonal of the rhombus. The line B-D transects line A-C at their mid-point at right angles and B-D is 60% of the length of A-C. Point B and D are chosen such that they lie beyond the lateral extents of the tracts. D-E is direct continuation of B-D and is equal in length to A-B. E-F is parallel to A-B and is equal in length to A-D. Just like a rhombus, lines $AB=BC=CD=AD=DE=EF$.

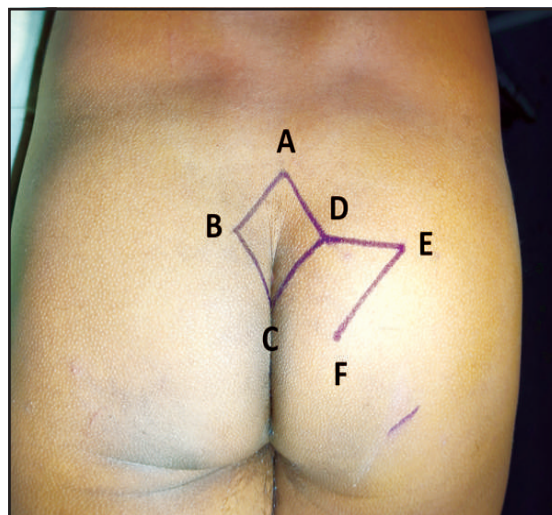


Fig 3: Mapping of the operative area with superimposed letters

Principle of the surgery is to excise the rhombus ABCD and to cover the area with DEF rotational flap as shown in the picture. Thus, D-E is sutured to B-A, E-F is sutured to A-D, C-D is sutured to C-B.

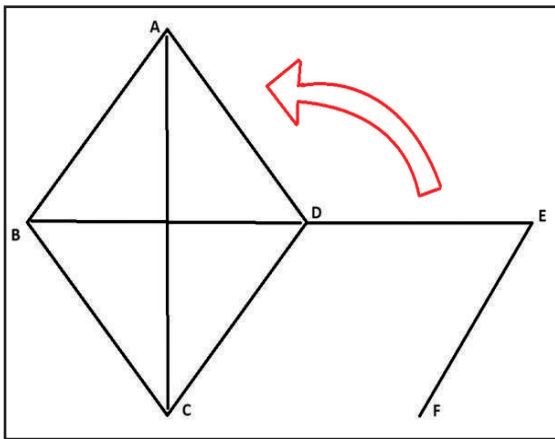


Fig 4 : Demonstration of the rotational flap

Painting of the area with 10% Povidone iodine done, and draping of the operative field done. The rhombus ABCD was incised. Skin and subcutaneous fat of the rhombus ABCD with all extensions of the sinus tracts was excised down to the deep fascia and removed. Most of the time, removal had to be done upto the periosteum of the underlying bone (coccyx).



Fig 5: Incision of the rhombus ABCD and dissection of subcutaneous fat



Fig 6 : Removal of rhombus ABCD

Then, the DEF flap is raised including the skin, subcutaneous fat and the fascia overlying the right gluteus maximus muscle.



Fig 7 : Raising of the DEF flap



Fig 8: Rotating the DEP flap over the defect

Then the DEF flap is rotated anticlockwise to cover the midline rhomboidal defect. The defect thus created by the elevation of the DEF flap is closed in linear fashion. Deep absorbable 2-0 polyglactin sutures (vicryl) to appose the fascia and subcutaneous fat were taken over a 16 Fr suction drain (Romovac).



Fig 9 : DEF flap rotated and fixed to cover the rhomboidal defect



Fig 10: Skin suturing and final outcome

Finally, skin apposed with interrupted mattress sutures with 2-0 monofilament polyamide

(Ethilon). By this flap, we can escape scarring in the midline, which prevents recurrences.

Post-operative management and Discharge:

The patient was put on IV antibiotic (Amoxicillin-clavulanic acid 1.2gm IV TDS) post-operatively that was changed to oral antibiotics after 3 days (Amoxicillin-clavulanic acid 625mg TDPC). Antibiotic was given for 7 days in total. Appropriate analgesics were given. The patient was advised to avoid putting pressure over the operative area for 3 weeks. Drain output type and amount was noted and was emptied every 24 hrs. All the patients were discharged with the suction drain in-situ, with advice to empty the drain regularly and measure the amount with maintenance of a chart. Drains were removed when output was <10ml/day. Alternate stitch was removed after 2 weeks and remaining stitched were removed after another 1 week (i.e. at 3 weeks).

Follow-up :

Patients were advised to review at 1 week, 2 weeks, 3 weeks, 3,6,9,12, 18 months, after surgery.



Fig 11 : Follow-up at 3 months

Statistical analysis :

Analysis was done using SPSS software version 25.0. Pearson's Chi-square Test was used to test the significance between the variables of the two groups.

Results :

In our study, the Mean Age (Mean $\pm$ s.d.) (Years) was 28.79 ± 6.339 . The Age distribution ranged from 20 to 41 years.

In our study, there were 14.3% (n=2) Females, and 85.7% (n=12) Males.

21.4% (n=3) patients presented with multiple tracts in sacrococcygeal region as evident in MRI

whereas 78.6% (n=11) patients presented with single sinus tract in the sacrococcygeal region.

The Mean Operative Time (Mean $\pm$ s.d.) (Mins) was 56.00 ± 5.684 . Operative Time for Limberg Flap Reconstruction ranged from 49-68 mins.

There was no case of Wound Infection in our study.

There was no case of Flap Necrosis in our study.

14.28% (n=2) patients had cut through of sutures during the period of wound healing, that was managed conservatively. Out of those patients who had cut through of sutures, one had single sinus tract and the other had multiple tracts.



Fig 12 : Cut through of suture noted at right angle of the wound

The Mean Post-Operative Stay (Mean $\pm$ s.d.) (Days) was 5.43 ± 0.938 . The post-operative number of days of stay ranged from 4 days to 7 days in the patients.

The Mean Post-Operative Day of Drain Removal (Mean $\pm$ s.d.) (Days) was 19.36 ± 2.170 . The Post-Operative Day of Drain Removal ranged from 16 days to 24 days in the patients.

The Mean Wound Healing Time (Mean $\pm$ s.d.) (Days) was 24.64 ± 3.225 . Wound Healing Time ranged from 21 – 28 days.

The Mean Number of Days to Return to Normal Activity (Mean $\pm$ s.d.) (Days) was 23.36 ± 2.205 . The Number of Days to Return to Normal Activity ranged from 21 days to 28 days in the patients.

The patients were followed up for 12 to 18 months in our study. The Mean Follow-up (Mean $\pm$ s.d.) (Months) was 15.43 ± 3.081 .

There was no case of Recurrence in the follow-up period in our study.

Serial No.	Age (Yrs.)	Sex	MRI	Operative Time (Mins)	Wound Infection	Flap Necrosis	Cut through of sutures	Post-operative stay (Days)	Drain Removal (POD)	Wound Healing Time (Days)	Return to daily activities (Days)	Follow-up (Months)	Recurrence
1	28	M	Single tract 4cm	54	No	No	No	4	18	21	22	12	No
2	34	M	Single tract 8cm	58	No	No	Yes	5	22	28	28	18	No
3	30	M	Y-shaped tract 7cm in cranio-caudal direction	56	No	No	No	5	19	21	24	12	No
4	20	M	Single tract 6cm	62	No	No	No	6	21	28	23	18	No
5	22	F	Single tract 5cm with abscess	54	No	No	No	5	17	21	21	12	No
6	24	M	Single tract 3cm	49	No	No	No	6	19	24	22	18	No
7	41	M	Multiple interconnected tracts with 3 external openings - Largest 8cm	68	No	No	Yes	6	24	28	28	18	No
8	39	M	Single tract 6cm	51	No	No	No	5	21	28	24	18	No
9	31	M	Single tract 5cm	55	No	No	No	4	18	21	22	12	No
10	29	M	Multiple interconnected tracts with 2 external openings - largest 6 cm	65	No	No	No	5	20	28	23	18	No
11	21	M	Single tract 4cm	52	No	No	No	7	17	24	23	18	No
12	25	F	Single tract 3cm with abscess	58	No	No	No	6	16	21	21	18	No
13	32	M	Single tract 7cm	52	No	No	No	5	20	28	22	12	No
14	27	M	Single tract 6cm	50	No	No	No	7	19	24	24	12	No

Table 1: Results summarized.

Discussion :

Our study comprises of a case series of 14 cases where we performed Limberg Transposition Flap for Sacro-coccygeal Pilonidal Sinus Treatment. Most patients were young with the mean age (Mean $\pm$ s.d.) being 28.79 ± 6.339 years in our study. The age distribution ranged from 20-41 years. In Jabbar et al^[11] study the mean age of 27.9 ± 5.96 years with young predominance. The age distribution ranged from 17-41 years.

In a study by Gündoğdu^[12], 80.1%(n=149) were males and 19.9% (n=37) were females. In our study, there were 85.7% (n=12) Males and 14.3% (n=2) Females, and There was a prominent male predominance in our study.

In a study by Karaca et al^[13], the Mean Operative time for Limberg Flap Reconstruction 59.64 ± 7.76 mins. In our study, the Mean Operative Time was 56.00 ± 5.684 mins.

In Chopade et al^[14] study, no cases of wound infection were seen in participants who underwent Limberg flap reconstruction surgery. In our study also, there were no cases of wound infection.

In Gündoğdu E^[12] study, there were no flap necrosis or ischemia, but one patient had dermal ischemia at the corner where the flap was removed. In our study also there was no case of Flap Necrosis but 2 patients had cut through of sutures during the period of wound healing that was managed conservatively by dressing.

In Karaca et al^[13] study, the Mean Hospital Stay

was 2.69 ± 2.32 days while in our study, the Mean Post-Operative Stay was 5.43 ± 0.938 days. We preferred dressing after 48 hours of surgery, then regular dressing.

In Arnous et al^[15] study, the Mean time of the patients' suction drain removal was 17.5 ± 5.5 days. In our study, the Mean Post-Operative Day of Drain Removal was 19.36 ± 2.170 days and the suction drain was only removed once the output was <10 ml in 24 hours.

In Chopade et al^[14] study, the mean healing time was 20 ± 2 days for limber flap reconstruction patients. In our study, the Mean Wound Healing Time was 24.64 ± 3.225 days.

In Arnous et al^[15] study, the Mean Number of Days to return to work was 20 ± 2.5 days. In our study, the Mean Number of Days to Return to Normal Activity was 23.36 ± 2.205 days.

In our study, patients were followed up for 12 to 18 months. The Mean Follow-up was for 15.43 ± 3.081 months. In Arnous et al^[15] study, the mean follow-up was for 16.4 ± 3.7 months.

There was no case of Recurrence in the follow-up period in our study which was similar to Gündoğdu E^[12] study.

Conclusion:

Limberg Transposition Flap is an effective surgical procedure to treat patients with pilonidal sinus disease. By this flap, we can escape scarring in the midline. This is cosmetically good, and there have been no cases of recurrence in our study.

References :

1. Gendy AS, Glick RD, Hong AR, Dolgin SE, Soffer SZ, Landers H, Herrforth M, Rosen NG. A comparison of the cleft lift procedure vs wide excision and packing for the treatment of pilonidal disease in adolescents. J Pediatr Surg. 2011 Jun;46(6):1256-9.
2. Aithal SK, Rajan CS, Reddy N. Limberg flap for sacrococcygeal pilonidal sinus a safe and sound procedure. Indian J Surg. 2013 Aug;75(4):298-301.
3. Karydakos GE. Easy and successful treatment of

- pilonidal sinus after explanation of its causative process. Aust N Z J Surg. 1992 May;62(5):385-9.
4. Datey S, Vashistha R, Gupta A, Gadodia M, Lazarus A, Verma P. Pilonidal sinus disease: a study of thirty six cases. *J Evolution Med Dental Sci*. 2015;4:16254–16257.
 5. Bascom J, Bascom T. Failed pilonidal surgery: new paradigm and new operation leading to cures. *Arch Surg*. 2002 Oct;137(10):1146-50; discussion 1151.
 6. Prospective randomized study of surgical treatment of pilonidal sinus; primary midline closure after elliptical excision versus rhomboid excision with limberg flap reconstruction versus open excision and healing by secondary intention. Kumar R, Hastir A, Walia RS, Goyal S, Kaur A. *Int Surg J*. 2017;4:3646–3651.
 7. Tocchi A, Mazzoni G, Bononi M, Fornasari V, Miccini M, Drumo A, Colace L. Outcome of chronic pilonidal disease treatment after ambulatory plain midline excision and primary suture. *Am J Surg*. 2008 Jul;196(1):28-33.
 8. Berger A, Frileux P. Sinus pilonidal [Pilonidal sinus]. *Ann Chir*. 1995;49(10):889-901.
 9. Casetecker J, Mann BD, Castellanes AF, Strauss J (2006) Pilonidal disease. <http://emedicine.medscape.com/article192668>. Accessed 11 Dec 2011.
 10. Wolfe SA, Alexander A. Limberg, M.D. 1894-1974. *Plast Reconstr Surg*. 1975 Aug;56(2):239-40.
 11. Jabbar MS, Bhutta MM, Puri N. Comparison between primary closure with Limberg Flap versus open procedure in treatment of pilonidal sinus, in terms of frequency of post-operative wound infection. *Pak J Med Sci*. 2018 Jan-Feb;34(1):49-53.
 12. Gündođdu E. Fasciocutaneous Elliptical Rotation Flap for Pilonidal Sinus Disease and Its Outcomes. *Turk J Surg*. 2020 Sep 28;36(3):310-316.
 13. Karaca AS, Ali R, Capar M, Karaca S. Comparison of Limberg flap and excision and primary closure of pilonidal sinus disease, in terms of quality of life and complications. *J Korean Surg Soc*. 2013 Nov;85(5):236-9.
 14. Chopade SP, Adhikari GR. Comparative Study of Limberg Flap Reconstruction With Wide-Open Excision and Healing by Secondary Intention in the Management of Pilonidal Sinus : Our Experience at a Tertiary Care Center in India. *Cureus*. 2022 Jun 28;14(6):e26396.
 15. Arnous M, Elgendy H, Thabet W, Emile SH, Elbaz SA, Khafagy W. Excision with primary midline closure compared with Limberg flap in the treatment of sacrococcygeal pilonidal disease: a randomised clinical trial. *Ann R Coll Surg Engl*. 2019 Jan;101(1):21-29.

Case Report

Acute Necrotising Encephalopathy of Childhood — A Case Report with Classical Imaging Finding

Shrabanti Roychoudhury

Abstract :

Acute Necrotising Encephalopathy of Childhood (ANEC) is a rapidly progressing fulminant encephalopathy with high mortality and morbidity. It follows viral febrile illness. Clinical symptoms are non-specific with fever, seizure, altered sensorium resulting in rapid neurological deterioration. Magnetic Resonance Imaging (MRI) features are characteristic and help to confirm the diagnosis.

Key words :

Acute Necrotising Encephalopathy, Trilaminar sign, Acute Disseminated Encephalomyelitis, Acute Necrotising Encephalopathy Severity Score

Introduction :

First described by Mizuguchi from Japan (1995), ANEC is rare, rapidly progressive encephalopathy affecting previously healthy children.^[1] It is distinguished by an acute clinical course and characteristic radiological pattern. The pathophysiology of ANEC remains partially understood. Viral infection is essential to initiate the disease pathogenesis. Influenza A, Rubella, Coxsackie 9, Measles, Herpes Simplex Virus (HSV), Human Herpes Virus 6, Enterovirus, Novel Reovirus, Rotavirus, Mycoplasma - all have been reported as etiological factors, the commonest being HHV-6.^[2]

Some authors describe the role of proinflammatory cytokines like IL-6, IL-1 and

Tumour Necrosis Receptor-1 in ANEC pathogenesis.^[3] In this hypothesis, cytokine storm is held responsible which is caused by excessive immune response to viral infection.

Although rapid progression is consistent, neurological manifestations of ANEC are nonspecific and include seizure, altered sensorium and focal neurological deficit. Hence, laboratory tests and imaging (MRI) play an important role.

Case report :

A 2 year old male child was referred to our hospital with a 3 day history of fever, burning micturition and decreased urine output. He had five or six episodes of convulsion from the second day of fever along with tonic involuntary movement of upper and lower limbs, deviation of mouth to left and upward rolling of the eyes. The child became drowsy from the third day along with diarrhoea and abdominal distension.

The general examination findings were unremarkable. The GCS score was E2M4V2.

Neurological examination showed bilateral extensor planter and brisk knee jerks. The rest of the systemic examination was unremarkable. Laboratory tests showed markedly raised liver transaminases (AST, ALTA) and LDH. Bilirubin and alkaline phosphatase were normal. C-reactive protein (CRP) was positive, and the platelet count was 41000 ml^{-1} . Electrolytes were on the higher side of normal, and antigens for dengue and

malaria were negative. EEG changes were consistent with diffuse encephalopathy. The CT scan of the brain, prior to admission, showed bilateral thalamic hypodensity. An MRI scan of the brain done in our institution showed bilaterally symmetric altered signal (T1 hypointensity and T2 hyperintensity) in thalami, brainstem, cerebellar and cerebral white matters.

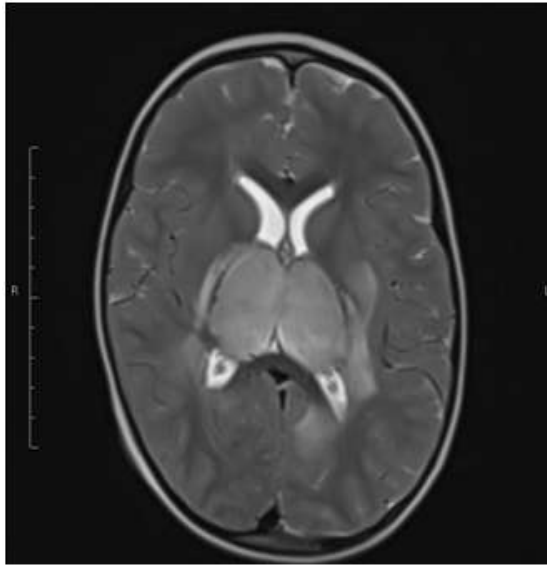


Fig 1. T2W Axial image showing symmetrical bulky T2 hyperintense thalami, internal capsule and left putamen.

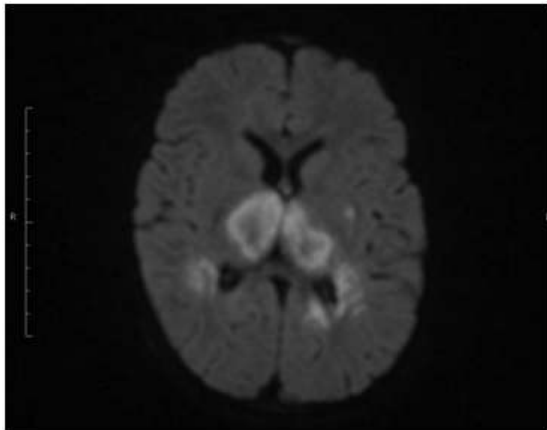


Fig 3. Restricted diffusion seen in bilateral thalami on DWI.

The left putamen and both internal capsules were also involved [fig 1 & 2]. Diffusion restriction was noticed on DWI sequence [fig. 3] Thalamic lesions showed the characteristic trilaminar sign on ADC map [fig 4]. Haemorrhage was present in thalami. A thin rim of enhancement was noticed in most of the lesions after contrast administration [fig 5, fig 6].

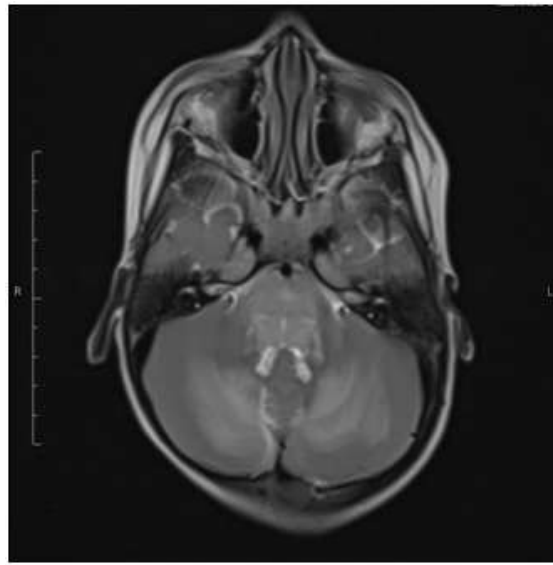


Fig 2. T2W Axial image showing T2 hyperintensity involving brainstem and cerebellar white matter in bilateral symmetrical manner.

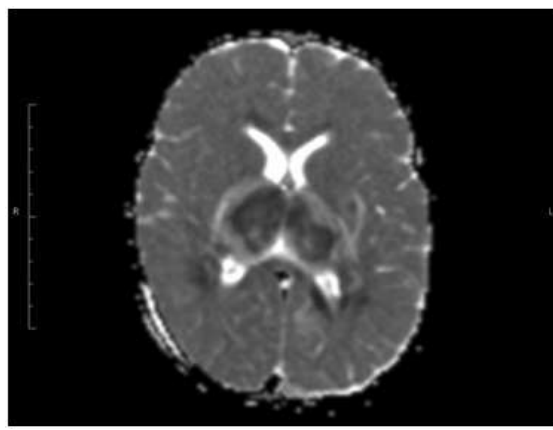


Fig 4. Tricolor or Trilaminar sign on ADC map.

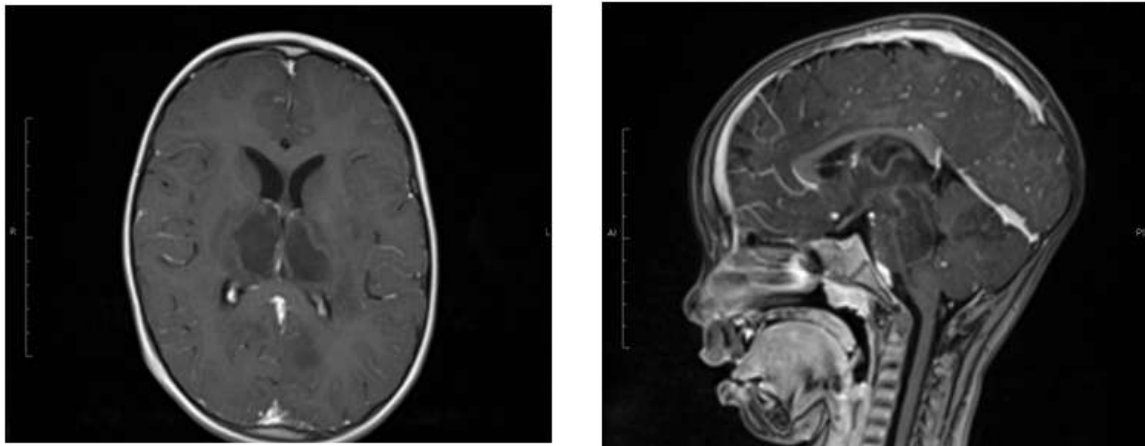


Fig 5. and Fig 6. Post contrast T1W images show thin rim enhancement of involved areas.

Discussion :

ANEC is a fatal neurological condition and its diagnosis is based on clinical features and typical MRI findings. The diagnostic criteria proposed by Mizuguchi et al. for acute necrotising encephalopathy are as follows:[4]

1. Acute encephalopathy following a viral febrile illness and rapid deterioration in the consciousness level, convulsion.
2. Increased cerebrospinal fluid (CSF) protein without CSF pleocytosis.
3. CT or MRI findings of symmetric multifocal brain lesions involving bilateral thalami, cerebral periventricular white matter, internal capsule, putamen, upper brain stem tegmentum, and cerebellar medulla without involvement of other CNS regions.
4. Elevation of serum aminotransferase of variable degree without hyperammonaemia.
5. Exclusion of other resembling diseases like overwhelming bacterial and viral infections, fulminant hepatitis, Reye syndrome, leigh encephalopathy, Acute Disseminated

Encephalomyelitis (ADEM), vasculitis, cerebral infarction and so on.

In presence of the characteristic MRI findings, differential diagnosis is limited. Clinically, ANEC may be differentiated from ADEM by early onset of encephalitic features just after the febrile illness whereas in ADEM, this usually occurs after 1 or 2 weeks. The other differential encephalitides can be excluded with help of laboratory findings. For example, ANEC is not associated with hyperammonaemia or lactic acidosis which are present in Reye syndrome and Leigh encephalopathy.

In ANEC, CSF shows raised protein without or minimal pleocytosis. In our case, a CSF study was not performed as the typical clinical setting and characteristic MRI findings established the diagnosis.

The distinctive neuroradiological manifestations of ANEC are multifocal, symmetric brain lesions with characteristic distribution in bilateral thalami, basal ganglia, brain stem, cerebral and cerebellar white matters.[5] The neuroradiological manifestations are characterised by dynamic

changes corresponding to the pathophysiological changes from oedema to petechial haemorrhage and then to necrosis.^[1]

The MRI scan also helps in predicting the neurological outcome and mortality risk by contributing to the Acute Necrotising Encephalopathy Severity Score (ANE-SS) which is a 0 – 9 scale used for prognosis of patients affected by ANEC.

The score includes : Shock (3 points)

Brainstem lesions (2 points)

Age over 48 months (2 points)

Platelet count below 100000 (1 point)

CSF protein above 60 mg (1 point)

ANE-SS categorizes patients into low risk (0 – 1 point), medium risk (2 – 4 points) and high risk (5 – 9 points) groups and helps clinicians to identify high risk patients early and initiate timely and appropriate treatment like immuno-suppressive therapy and supportive care. Overall, ANEC is a clinico-radiological syndrome.^[6]

Conclusion :

ANEC is a rare and rapidly progressive disease with poor outcome. Multiparametric MRI plays a crucial role in confirming clinical suspicion with its characteristic findings and helps in early initiation of treatment. Early detection and appropriate treatment may lead to better neurological outcome. MRI scoring has a positive correlation with clinical outcome.

References :

1. Mizuguchi M, Abe J, Mikkaichi K, Noma S, Yoshida K, Yamanaka T, Kamoshita S. Acute necrotising encephalopathy of childhood : a new syndrome presenting with multifocal, symmetric brain lesions. *J Neurol Neurosurg Psychiatry*. 1995;58:555–561. doi: 10.1136/jnnp.58.5.555. [DOI] [PMC free article] [PubMed] [Google Scholar]
2. Wu X, Wu W, Pan W, Wu L, Liu K, Zhang HL. Acute necrotizing encephalopathy : an underrecognized clinicoradiologic disorder. *Mediators Inflamm*. 2015;2015:1-10. [DOI] [PMC free article] [PubMed] [Google Scholar]
3. Wong AM, Simon EM, Zimmerman RA, Wang HS, Toh CH, Ng SH. Acute necrotizing encephalopathy of childhood: correlation of MR findings and clinical outcome. *Am J Neuroradiol*. 2006;27(9):1919-23. [PMC free article] [PubMed] [Google Scholar]
4. Mizuguchi M. Acute necrotizing encephalopathy in childhood: a novel form of acute encephalopathy prevalent in Japan and Taiwan. *Brain Dev*. 1997;19:81–92. doi: 10.1016/s0387-7604(96)00063-0. [DOI] [PubMed] [Google Scholar]
5. Lyon JB, Remigio C, Milligan T, Deline C (2010) Acute necrotizing encephalopathy in a child with H1N1 influenza infection. *PediatrRadiol* 40(2):200–205 Article Google Scholar.
6. Vanaki, R. N., Diwanmal, S. B., Rajesh Pol, R., Yelamali, B. C., Kulkarni, M. R., Brahmandbher, S. V. (2020). Acute necrotizing encephalopathy of childhood: an under-recognized and diverse clinico-radiological syndrome. *International Journal of Contemporary Pediatrics*, 7(11), 2106–2111. <https://doi.org/10.18203/2349-3291.ijcp20204468>.

Case Report**Cochlear Implantation as A Rehabilitation Aid for Deaf Adults**Anurag Mandal¹, Moumita Sen¹, Ushirin Bose², Baisakhi Bakat³, Soumitra Ghosh⁴, Chandan Saha⁵**Abstract :**

Hearing loss of various aetiologies has become a burden worldwide. Among them, sensorineural hearing loss (SNHL) presents a significant challenge, as hearing aids were the only available treatment until the beginning of this century. In people with severe to profound SNHL, hearing aids often could not provide adequate support. As a result, patients with bilateral severe to profound SNHL faced significant financial hardship. Gradually, the situation worsens, impacting one's mental and cognitive well-being.

Cochlear implantation (CI) has emerged as a hearing solution to overcome hearing loss in adult patients suffering from presbycusis, single-sided deafness, and skull base tumour. The CI device delivers good auditory rehabilitation, and with speech therapy, it may re-establish normal communication skills in the personal and professional sphere. Thus, cochlear implantation has gained popularity as an auditory rehabilitation tool for adult sensorineural hearing loss.

Key words :

Sensorineural hearing loss, cochlear implant, speech therapy, mapping, auditory rehabilitation

Introduction :

Hearing loss is one of the most common health problems, with a global burden of 1.4 billion (18.7%) in 2017^[1]. The World Health Organisation estimated that 466 million people globally are suffering from disabling hearing

loss (bilateral moderate hearing loss or worse)^[2]. Around 100 million people amongst them are from India^[3,4,5]. Being deaf in both ears prevents an active social and professional life, restricting economic support. Hearing aids can help some people for the rest of their lives. But in some advanced cases, hearing aids fail to provide adequate amplification. Cochlear implants are a blessing for those people, helping them rejuvenate their lives. A careful clinical examination, radiological evaluations, and choosing well-motivated patients are the key to success.

After cochlear implantation, a long period of follow-up in the form of auditory rehabilitation and mapping is a prerequisite to get the best hearing outcome. Cochlear implantation can provide hearing in children born with irreversible sensorineural hearing loss, which can be utilised for speech and language development in these children. Over the decades, adult patients with severe to profound sensorineural hearing loss who do not benefit from conventional hearing aids are proving to be good candidates for cochlear implantation.

Case Report :

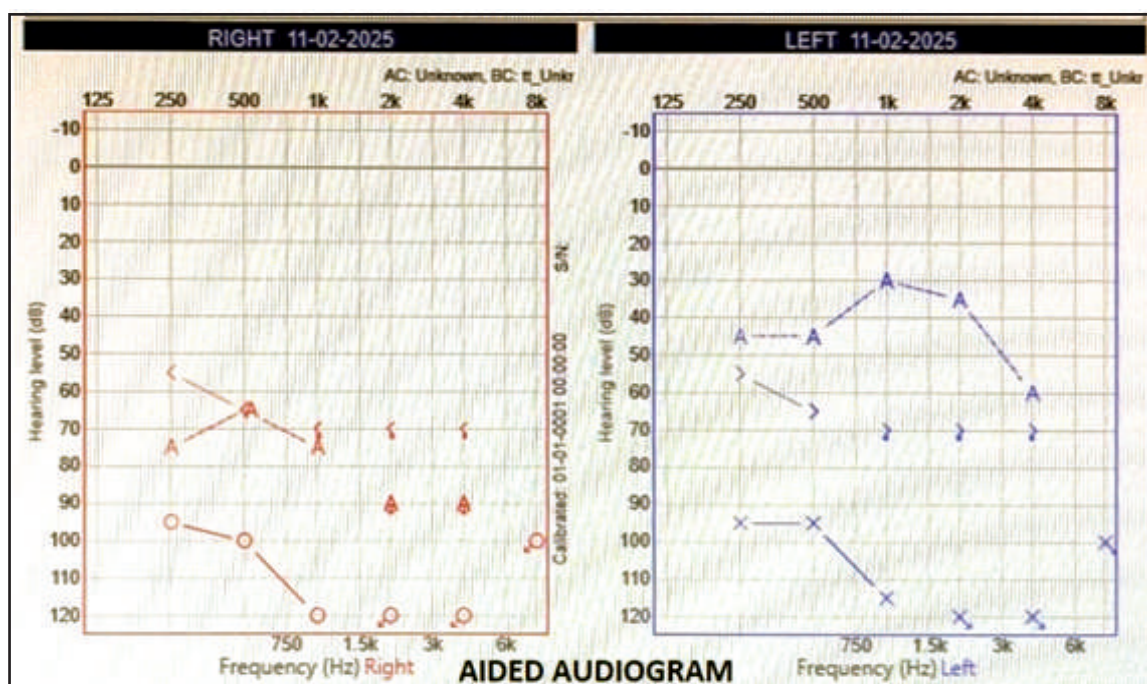
A 53-year-old male was suffering from gradually diminished hearing in both ears over the last nine years. He lost any serviceable hearing in his right ear four years prior. But in the last three years, hearing in his left ear reduced severely enough to prevent him from establishing fruitful communication in real life, which jeopardised

¹Senior Resident, ²Assistant Professor, ³Medical Officer, ⁴Associate Professor, ⁵Speech & Language Pathologist — Department of ENT Head Neck Surgery, RKMS

his business. He was using a hearing aid in his left ear for two to three years, which failed to deliver adequate audiological benefit. As the head of a family with two children, he was left with no alternative way of earning.

On presentation to our OPD, we elicited a thorough history, clinical examinations with Aided Audiometry, BERA, High-resolution CT Scan, and MRI Temporal Bones. His audiometry showed a bilateral profound degree of

sensorineural hearing loss. With Ultra Power VBTE hearing aids, thresholds were completely out of the speech spectrum in the right ear and at the lower limit of the speech spectrum in the left ear. Response to speech therapy with a hearing aid was restricted to sound detection only; no discrimination was seen in the left ear. His radiological investigations were favourable to cochlear implantation, with no anatomical variations. He was a known case of Type 2 Diabetes Mellitus and COPD.



The patient was counselled in detail for cochlear implantation as the only feasible option regarding audiological rehabilitation. We performed Left-sided cochlear implantation with CI 422 SRA electrode arrays successfully in April 2025. Intraoperative assessment showed a satisfactory response in Impedance and Neural Response Telemetry in all 22 electrodes, which equates to a very favourable future response. The patient

was discharged on the 8th postoperative day. The patient returned for follow-up on the 14th postoperative day in the OPD, where the switch-on procedure was performed successfully, and he could hear efficiently.

The patient was regularly followed up in the audiology clinic, where proper calibration (mapping) of the cochlear implant was done at

a regular interval, along with speech therapy to derive optimal outcome. The patient can hear better and can respond well to sound stimulus. At present, the patient can converse normally in a quiet ambient environment after six weeks of surgery; he can identify the source of sound and tonal characters of voice to identify the speaker among a group of people without looking at them. However, the direction of the incoming sound is not yet well established. He is no longer relying upon lip-reading, which he used to interact with people previously. His Modified CAP (Categorical Auditory Performance) score and SIR (Speech Intelligibility Rating) score are 6 (understands conversation without lip-reading) and Category 4 (connected speech intelligible to a listener who has a little experience of a deaf person's speech. The listener does not need to concentrate unduly) respectively. Overall, our patient is happy with the cochlear implant, which has given the entire family a new, rejuvenated life in terms of work and social communication.



Discussion :

The cochlear implant was first implanted by Dr. William F. House and John Doyle in 1961 in Los Angeles, California, after detailed study and animal experimentations^[6,7,8,9]. The first permanent cochlear implantation was done in 1964 with a 6-channel electrode array by Blair Simmons and Robert White^[6]. Over the years, with advancements in the field of electronics, material science, and digital technology, better, smaller, slim-profiled, yet powerful implants are manufactured by various companies with a similar success rate all over the globe. However, the cost of the device makes it hard for everyone to access this technology in developing countries.

Cochlear implantation has become the mainstay of treatment in children below six years with severe to profound hearing loss in both ears, presenting as non-development of speech. This blessing has changed the lives of thousands of young people from being handicapped to a productive and purposeful life.

Cochlear implantation in post-lingual adults started earlier with a single-channel electrode, which proved the concept in humans but yielded only the perception of sound without speech discrimination or word recognition. Over the years, technological advancement has achieved a better outcome at a later date. According to the literature, approximately 82% of patients with post-lingual hearing loss will have improved speech perception performance post cochlear implantation in a meta-analysis study^[9]. In 2013, a multi-centric study involving 2251 patients by Peter Blamey et al. advocated using a hearing aid before the period of severe to profound hearing loss to dampen age-related cognitive changes^[10]. They also recommended using cochlear implantation before 75 years of age for

better outcome^[10]. Most of the beneficial effects are stable and do not wane over time as age advances. For better sound and tonal quality, and sound localisation, bilateral cochlear implantation is often recommended.

Ramakrishna Mission Seva Pratishthan has been running a cochlear implantation programme for the last two decades, both under the Government of India scheme and privately funded schemes. Numerous children and adults have benefited from cochlear implant surgery during this period.

References :

1. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories 1990-2017 : A systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018;392:1789-858.
2. World Health Organization. Addressing the rising prevalence of hearing loss. 2018. Geneva : WHO; Available at www.who.int/pbd/deafness/estimates/en/
3. World Health Organization, Regional Office for South-East Asia. State of hearing and earcare. 2005. Geneva: WHO Regional Office for South-East Asia; Available at <http://apps.who.int/iris/bitstream/handle/10665/205911/B1466.pdf?>
4. Disabled Persons in India. NSS 58th round (July-December 2002) Report No. 485 (58/26/1) National Sample Survey Organization, Ministry of Statistics and Programme Implementation. 2003. Government of India. Available at http://mospi.nic.in/sites/default/files/publication_reports/485_final.pdf.
5. Ministry of Statistics and Programme Implementation. Disabled persons in India: A statistical profile 2016. 2016. New Delhi: Social Statistics Division, Ministry of Statistics and Programme Implementation, Government of India; http://mospi.nic.in/sites/default/files/publication_reports/Disabled_persons_in_India_2016.pdf.
6. Mudry A, Mills M. The Early History of the Cochlear Implant: A Retrospective. *JAMA Otolaryngol Head Neck Surg*. 2013;139(5):446-453. doi:10.1001/jamaoto.2013.293.
7. House WF. Cochlear implants. *Ann Otol Rhinol Laryngol*. 1976;85 (3, pt 2) (suppl 27):1-93.
8. House LR. Cochlear implant: the beginning. *Laryngoscope*. 1987; 97(8, pt 1):996-997.
9. Boisvert I, Reis M, Au A, Cowan R, Dowell RC (2020) Cochlear implantation outcomes in adults: A scoping review. *PLoS ONE* 15(5):e0232421.
10. Blamey, P; Artieres, F; et al (2013). Factors Affecting Auditory Performance of Postlinguistically Deaf Adults Using Cochlear Implants : An Update with 2251 Patients. *Audiology and Neurotology*, 18(1):36-47.

Case Report

A Rare Case of Recurrent Euvolemic Hyponatremia and Monoclonal IgG Paraproteinemia in a Case of Multisystemic Sarcoidosis : A Case Report

Satyaki Mitra¹, Ajitesh Roy², Parthajit Das³

Abstract :

Introduction :

Sarcoidosis is a multisystemic inflammatory disorder of unknown etiology, characterized by the formation of non-caseating granulomas in various organs. While pulmonary involvement is most common, extrapulmonary manifestations can present significant diagnostic and therapeutic challenges. Neurosarcoidosis, particularly involving the hypothalamic-pituitary axis, is a rare but serious complication that can lead to endocrine dysfunction, including hyponatremia. The association between chronic inflammatory states like sarcoidosis and the development of monoclonal gammopathies is also recognized but remains an area of ongoing research.

Case Presentation :

We present the case of a 68-year-old female with a history of hypertension and type 2 diabetes mellitus who was admitted with severe prostration and uncontrolled hyperglycemia. Her history was notable for recurrent episodes of severe hyponatremia, uveitis, and skin lesions resembling erythema nodosum. Initial investigations revealed euvolemic hyponatremia and panhypopituitarism, including central hypothyroidism and adrenal insufficiency. Imaging studies, including Magnetic Resonance

Imaging (MRI) of the brain and a Fluorodeoxyglucose Positron Emission Tomography (FDG-PET) scan, confirmed pituitary and myocardial involvement, leading to a diagnosis of multisystemic sarcoidosis. The patient responded dramatically to immunosuppressive therapy with steroids and levothyroxine replacement. However, six months later, she presented again with persistent weakness and anemia. Further evaluation revealed a monoclonal IgG lambda paraprotein on serum protein electrophoresis and immunofixation, with bone marrow examination showing dyspoiesis, consistent with Monoclonal Gammopathy of Undetermined Significance (MGUS).

Conclusion :

This case highlights the complex interplay of endocrine, inflammatory, and hematological manifestations in a single patient with sarcoidosis. It underscores the importance of considering neurosarcoidosis in the differential diagnosis of recurrent euvolemic hyponatremia and pituitary dysfunction. Furthermore, it illustrates the potential for chronic inflammation in sarcoidosis to predispose patients to plasma cell dyscrasias like MGUS. Clinicians should maintain a high index of suspicion for these associated conditions

¹Senior Resident, Department of General Medicine, RKMS; ²Professor, Department of Endocrinology, RKMS; ³Assistant Professor, Department of General Medicine, RKMS

to ensure timely diagnosis and appropriate management, including long-term surveillance for the potential progression of MGUS to multiple myeloma.

Introduction :

Sarcoidosis is a complex, multisystemic disease characterized by the pathological hallmark of non-caseating granulomas in affected tissues.^[1] The etiology remains elusive, though it is widely believed to result from an exaggerated immune response to an unidentified antigen in genetically susceptible individuals. The clinical presentation of sarcoidosis is notoriously heterogeneous, ranging from asymptomatic incidental findings to severe, life-threatening organ dysfunction. While the lungs and lymphatic system are involved in over 90% of cases, virtually any organ can be affected.^[2]

Extrapulmonary sarcoidosis can pose a significant diagnostic challenge due to its diverse and often subtle manifestations. One of the rarer but more serious forms is neurosarcoidosis, which occurs in 5-10% of patients.^[3] Neurological involvement can affect any part of the central or peripheral nervous system, with cranial neuropathies, aseptic meningitis, and hydrocephalus being common presentations. Involvement of the hypothalamic-pituitary axis is a particularly infrequent manifestation, occurring in less than 1% of all sarcoidosis patients, but it can lead to profound endocrine disturbances.^[4] These disturbances may include diabetes insipidus, anterior pituitary hormone deficiencies (hypopituitarism), and disorders of water balance, such as the syndrome of inappropriate antidiuretic hormone secretion (SIADH), resulting in hyponatremia. Hyponatremia in sarcoidosis can also arise from other mechanisms, including primary polydipsia, adrenal insufficiency, or dysregulated calcium

metabolism.^[5]

Another intriguing and less understood association is the link between sarcoidosis and hematological abnormalities, particularly plasma cell dyscrasias. Chronic inflammation is a known risk factor for the development of monoclonal gammopathies, where a clone of plasma cells produces a monoclonal immunoglobulin (M-protein).^[6] Monoclonal Gammopathy of Undetermined Significance (MGUS) is the most common of these disorders and is considered a premalignant precursor to multiple myeloma.^[7] The persistent systemic inflammation and immune dysregulation inherent to sarcoidosis may create a microenvironment conducive to the clonal expansion of plasma cells, leading to an increased incidence of MGUS in this patient population.^[8]

This report details the intricate case of a 68-year-old woman who initially presented with features of pituitary insufficiency, leading to a diagnosis of multisystemic sarcoidosis with rare hypothalamic-pituitary and cardiac involvement. Her clinical course was further complicated by the subsequent development of a monoclonal IgG paraproteinemia, highlighting the confluence of endocrine and hematological sequelae of this multifaceted disease. Through this case, we aim to discuss the diagnostic pathway for neurosarcoidosis, the pathophysiology of associated hyponatremia, and the clinical implications of the co-occurrence of sarcoidosis and MGUS.

Case Presentation :

A 68-year-old female with a long-standing history of hypertension and type 2 diabetes mellitus presented to the emergency department of Ramakrishna Mission Seva Pratishthan

Vivekananda Institute of Medical Sciences with a one-month history of severe weakness and uncontrolled hyperglycemia. She also reported intermittent vomiting and anorexia for the preceding six months.

Past Medical History and Further Enquiry :

On further questioning, the patient revealed a more extensive history of symptoms spanning several years. For the last five years, she had experienced low back pain, intermittent holocephalic headaches, and multiple episodes of painful red eyes, which had been diagnosed as recurrent uveitis. Over the past three to four years, she had developed recurrent, painful subcutaneous nodules over her shins, suggestive of erythema nodosum. She had no other significant past medical history and had reached menopause at the age of 49. A detailed negative history revealed no prior surgery, no symptoms suggestive of diabetic micro- or macrovascular complications, no autonomic neuropathy, and no history of tuberculosis exposure or recent fractures.

Clinical Examination :

Upon examination, the patient was alert and oriented but appeared severely asthenic. Her vital signs were : blood pressure 110/70 mmHg, pulse 102 beats per minute, and respiratory rate 18 breaths per minute. Her weight was 66 kg, and her BMI was 28.1kg/m². There were no signs of dehydration or edema. Physical examination revealed pallor, but no lymphadenopathy or icterus. The remainder of the systemic examination was within normal limits.

Initial Investigations and Diagnosis of Neurosarcoidosis :

Initial laboratory investigations were significant

for hyponatremia (Na: 123 mEq/L), uncontrolled hyperglycemia (Fasting Blood Sugar: 125 mg/dL, Post-Prandial Blood Sugar: 243 mg/dL), a normocytic, hypochromic anemia (Hb: 10.1 g/dL), and a markedly elevated erythrocyte sedimentation rate (ESR: 100 mm in 1st hour).

Given the constellation of recurrent uveitis, erythema nodosum, and new-onset hyponatremia with weakness, an underlying systemic inflammatory disease was suspected. Endocrine evaluation was pursued to investigate the cause of the euvolemic hyponatremia. The results were consistent with panhypopituitarism:

- **Thyroid Axis :** Low free T4 (fT4: 0.86 ng/dL; ref 0.93-1.7) with an inappropriately normal TSH (0.55 mIU/mL; ref 0.27-4.2), indicating central hypothyroidism.

- **Adrenal Axis :** An 8 AM serum cortisol level was inappropriately normal, which, in the context of severe systemic stress and illness, pointed towards central adrenal insufficiency.

- **Gonadotropic Axis :** Follicle-stimulating hormone (FSH) and luteinizing hormone (LH) levels were inappropriately normal for a postmenopausal woman, further supporting pituitary dysfunction.

- **Prolactin :** Prolactin was mildly elevated at 28.4 ng/mL (ref 4.79-23.3), likely due to pituitary stalk compression ("stalk effect").

To localize the pathology, an MRI of the hypothalamo-pituitary region was performed. It revealed diffuse enlargement of the pituitary gland with diffuse contrast enhancement and significant thickening of the pituitary stalk. These findings, in a patient with multisystemic inflammatory features, were highly suggestive of neurosarcoidosis.

Further investigations were conducted to assess the extent of systemic involvement and rule out mimics.

- **Serum Angiotensin-Converting Enzyme (SACE) :** The SACE level was elevated at 73 U/L.

- **High-Resolution Computed Tomography (HRCT) of the Thorax :** Showed a few scattered, calcified granulomas in both lung fields but no evidence of active inflammation, hilar lymphadenopathy, or pulmonary fibrosis.

- **Fluorodeoxyglucose Positron Emission Tomography (FDG-PET) Scan :** A planned bronchoscopy was abandoned due to the patient's

frailty. An FDG-PET scan was performed instead, which revealed metabolically inactive calcified granulomas in the lungs. However, it demonstrated mildly increased FDG uptake in the pituitary region and, significantly, increased FDG uptake in the left ventricular myocardium with a minimal pericardial effusion, confirming active cardiac sarcoidosis.

- **Cardiac MRI :** Showed no evidence of myocardial scarring or late gadolinium enhancement.

Autoimmune and Infectious Workup : Tests for SS-A, SS-B, ANCA, and IgG4 were all negative, ruling out other systemic autoimmune diseases.

Routine Investigations	
FBS	125 mg/dL
PPBS	243 mg/dL
Na	123 mg/dL
K	4.9 mg/dL
Corrected Ca	9.1 mg/dL
Creatinine	1.2 mg/dL
Uric Acid	6.2 mg/dL
Urine MACR	35.3
Hb	10.1 gm/dL
TC	8700/cmm - $N_{72}L_{21}M_{5}E_{2}B_{9}$
ESR	100 mm in 1 st hour

Further Investigations	
TSH	0.55 mIU/mL (0.27-4.2 mIU/mL)
FT4	0.86 ng/dL (0.93-1.7 ng/dL)
TT3	0.98 ng/mL (0.8-2.0 ng/mL)
LH	1.7 mIU/mL (1.1-7.0 mIU/mL)
FSH	9.73 mIU/mL (1.7- 12.0 mIU/mL)
Prolactin	28.4 mIU/mL (4.79-23.3 mIU/mL)
8am S. cortisol	26.0 mg/mL (4.82-19.5 ng/dL)
SACE	73 U/L
COVID-19 RTPCR	Negative
COVID Ab	26.0 mg/mL (4.82-19.5 ng/dL)
Echo	Concentric LVH, LVEF – 60%, E/E' – 11, grade 1 LVDD

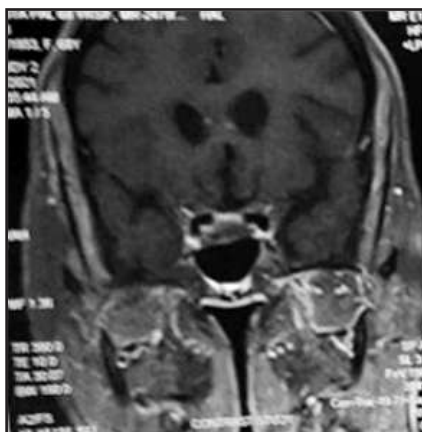


Image 1, Image 2 : Diffuse enlargement of the pituitary gland with diffuse contrast enhancement and significant thickening of the pituitary stalk.

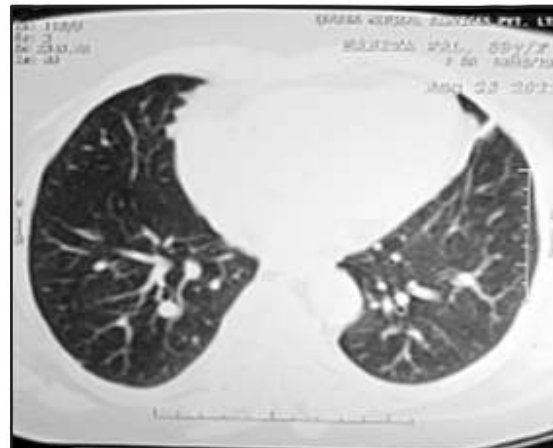


Image 3, Image 4: few scattered, calcified granulomas in both lung fields.

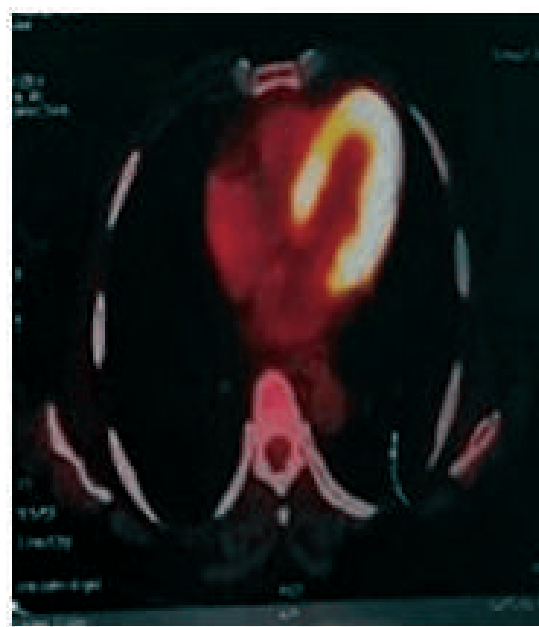
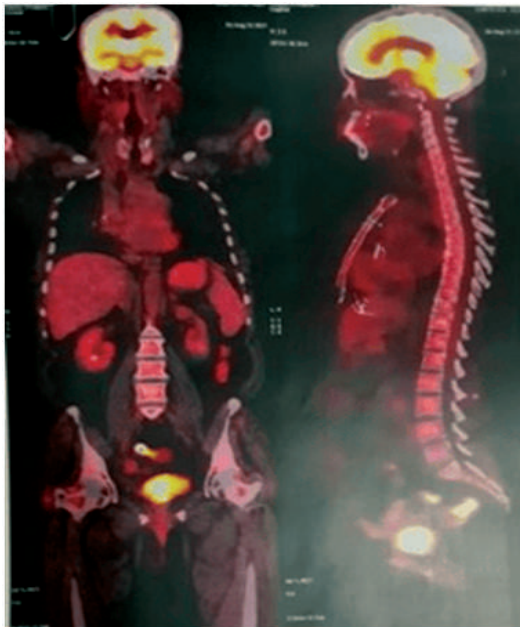


Image 5, Image 6 : metabolically inactive calcified granulomas in the lungs. However, it demonstrated mildly increased FDG uptake in the pituitary region and, significantly, increased FDG uptake in the left ventricular myocardium with a minimal pericardial effusion, confirming active cardiac sarcoidosis.

Based on the combination of clinical evidence (uveitis, erythema nodosum), biochemical evidence (panhypopituitarism, high SACE), and characteristic imaging findings (pituitary stalk

thickening on MRI, cardiac and pituitary uptake on PET scan), a provisional diagnosis of multisystemic sarcoidosis with pituitary and cardiac involvement was made.

Management and Initial Outcome :

The patient was started on hormone replacement therapy with levothyroxine and a therapeutic dose of oral steroids for the management of sarcoidosis, which was later tapered to a maintenance dose. Her hyperglycemia was managed with insulin. The patient showed a dramatic clinical improvement. Her weakness resolved, and she had no further episodes of hyponatremia or uveitis.

Follow-up and Development of Monoclonal Gammopathy :

Six months after her initial diagnosis and treatment, the patient presented again with generalized body ache and persistent weakness. Repeat laboratory workup revealed a worsening anemia (Hb: 8.8 g/dL) and a persistently elevated ESR (73 mm/hr). Her iron profile was consistent with iron deficiency, but her symptoms and elevated ESR did not improve despite iron replacement therapy.

This prompted a further hematological investigation.

- **Serum Protein Electrophoresis (SPEP) :** Revealed an M-band in the gamma globulin region.
- **Serum Immunofixation :** Confirmed the presence of a monoclonal IgG lambda paraprotein.
- **Quantitative Immunoglobulins :** IgG level was 13.5 g/L (within the normal range).
- **Serum Free Light Chains :** Showed elevated free kappa (58.68 mg/L; ref 3.3-19.4) and lambda chains (95.59 mg/L; ref 5.71-26.3), with a normal kappa/lambda ratio of 0.61.
- **Beta-2 Microglobulin :** Was elevated at 3.28 mg/L (ref 0.6-2.45).

A bone marrow examination was performed to rule out multiple myeloma. The aspirate and biopsy showed evidence of dyspoiesis, erythroid hyperplasia, and dysmegakaryopoiesis. Plasma cells were within normal limits (1.8-2%), and there was no evidence of granulomas, infiltration, or infection.

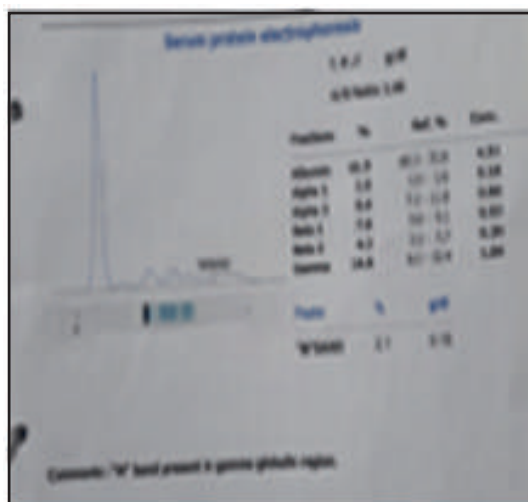


Image 7 : M-band in the gamma globulin region.



Image 8 : Confirmed the presence of a monoclonal IgG lambda paraprotein.

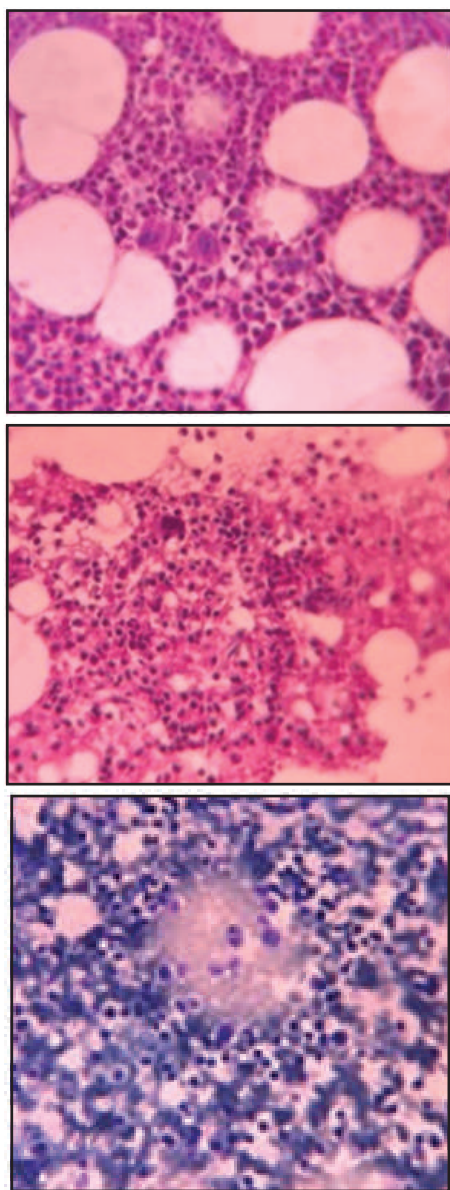


Image 9, Image 10, Image 11 : evidence of dyspoiesis, erythroid hyperplasia, and dysmegakaryopoiesis.

The final diagnosis was updated to multisystemic sarcoidosis with a concurrent Monoclonal Gammopathy of Undetermined Significance (MGUS). The diagnostic dilemma was whether

these were two separate disease entities or if the chronic inflammation from sarcoidosis had precipitated the plasma cell dyscrasia. The patient is currently under regular follow-up for both conditions, with surveillance for the potential progression of MGUS to multiple myeloma.

Discussion :

This case presents a remarkable convergence of rare manifestations and complications of sarcoidosis, offering valuable insights into the disease's diagnostic and management complexities. The discussion will focus on three key aspects of this case: the diagnostic challenge of neurosarcoidosis presenting as hyponatremia, the role of advanced imaging like FDG-PET in diagnosing multisystemic sarcoidosis, and the clinical significance of the subsequent development of MGUS.

Neurosarcoidosis, Hypopituitarism, and Hyponatremia :

Neurosarcoidosis is a chameleon of neurology, capable of mimicking a vast array of neurological disorders. Our patient's presentation with severe asthenia and recurrent hyponatremia ultimately pointed towards an endocrine etiology rooted in the central nervous system. The diagnosis of neurosarcoidosis involving the hypothalamic-pituitary region was established through a combination of clinical suspicion, biochemical evidence of panhypopituitarism, and characteristic MRI findings of pituitary stalk thickening and enhancement. This presentation is consistent with existing literature, which describes granulomatous infiltration of the pituitary stalk and hypothalamus as the primary mechanism of endocrine dysfunction in neurosarcoidosis.^[3, 4]

The hyponatremia in this patient was euvolemic and multifactorial. The primary driver was central

adrenal insufficiency, leading to impaired free water excretion due to the non-osmotic release of ADH. Central hypothyroidism likely contributed by reducing cardiac output and the glomerular filtration rate. While SIADH is a well-described cause of hyponatremia in neurosarcoidosis, often due to direct hypothalamic infiltration, the patient's inappropriately normal cortisol levels in the face of illness made adrenal insufficiency a more prominent factor. The dramatic resolution of hyponatremia following steroid and levothyroxine replacement therapy confirms the central role of these pituitary hormone deficiencies. This case underscores the critical importance of a thorough endocrine evaluation in any patient with sarcoidosis presenting with unexplained hyponatremia, as prompt hormone replacement is both diagnostic and life saving.

The Role of FDG-PET/CT in Diagnosing Multisystemic Sarcoidosis :

A definitive diagnosis of sarcoidosis typically requires histological confirmation of non-caseating granulomas.^[2] However, obtaining tissue from sites like the pituitary or heart is often high-risk and impractical. In such cases, a probable diagnosis is made based on a compatible clinical and radiological picture after excluding other granulomatous diseases. Our patient's clinical frailty precluded bronchoscopy, a common diagnostic procedure. This is where FDG-PET/CT played a pivotal role. FDG-PET/CT is an invaluable tool in sarcoidosis, particularly for identifying occult sites of active inflammation, assessing the extent of disease, and guiding biopsies.^[10] In this case, the PET scan provided crucial, non-invasive evidence of active inflammation in both the pituitary gland and the myocardium. The finding of cardiac

sarcoidosis was particularly significant, as it is a major cause of morbidity and mortality in sarcoidosis, often leading to heart failure, arrhythmias, and sudden death.^[11] The PET scan not only solidified the diagnosis of multisystemic sarcoidosis but also fundamentally altered the patient's management by identifying life-threatening cardiac involvement that required aggressive immunosuppressive therapy. This highlights the recommendation from expert consensus statements to use advanced imaging like cardiac PET or MRI for screening in patients with evidence of extracardiac sarcoidosis.^[11]

Sarcoidosis and Monoclonal Gammopathy: A Causal Link?

The development of MGUS six months after the initial diagnosis raises questions about the relationship between sarcoidosis and plasma cell dyscrasias. A growing body of evidence suggests that this association is more than coincidental.^[8] Sarcoidosis is characterized by profound immune dysregulation, including polyclonal B-cell activation and hypergammaglobulinemia, driven by a T-helper 1 (Th1) and Th17 cytokine milieu. It is hypothesized that this state of chronic antigenic stimulation and inflammation can, over time, promote the emergence of a malignant or premalignant plasma cell clone.^[6]

Studies have reported a higher prevalence of MGUS in patients with sarcoidosis compared to the general population.^[8] A study by Blanchard et al. found that patients with chronic inflammatory diseases, including sarcoidosis, had a significantly increased risk of developing MGUS.^[6] The persistently elevated ESR and development of anemia of chronic disease (with a component of iron deficiency) in our patient, even after initial treatment, were red flags that rightly prompted a workup for an underlying

plasma cell disorder. The bone marrow finding of dyspoiesis further complicates the picture, suggesting a more global impact on hematopoiesis, which can be seen in both chronic inflammatory states and clonal hematologic disorders.

The diagnosis of MGUS carries significant clinical implications. While benign, MGUS has a consistent risk of progression to multiple myeloma or other lymphoproliferative disorders at a rate of approximately 1% per year.^[7] Therefore, our patient requires long-term hematological surveillance, including regular monitoring of her M-protein levels and clinical status, in addition to the ongoing management of her sarcoidosis. This dual diagnosis complicates management, as the immuno-suppressive therapies used for sarcoidosis could potentially impact the immune surveillance of the monoclonal clone.

Conclusion : This case report details the complex clinical journey of a patient with multisystemic sarcoidosis, whose presentation was marked by

rare endocrine and hematological complications. It highlights several key learning points for clinicians. First, neurosarcoidosis should be a key differential in patients presenting with panhypopituitarism and recurrent euvolemic hyponatremia, particularly in the presence of other systemic inflammatory signs. Second, advanced imaging modalities like FDG-PET/CT are indispensable for the non-invasive diagnosis and assessment of disease activity in sarcoidosis, especially when biopsy is not feasible and for detecting high-risk organ involvement like cardiac sarcoidosis. Finally, clinicians should be aware of the recognized association between sarcoidosis and plasma cell dyscrasias. Persistent inflammatory markers or unexplained anemia in a patient with sarcoidosis should prompt an evaluation for an underlying monoclonal gammopathy. This case serves as a powerful reminder of the protean nature of sarcoidosis and the importance of a multidisciplinary, vigilant approach to managing its diverse and challenging manifestations.

References :

1. Valeyre D, Prasse A, Nunes H, Uzunhan Y, Brillet PY, Müller-Quernheim J. Sarcoidosis. *Lancet*. 2014;383(9923):1155-1167.
2. Statement on sarcoidosis. ATS Committee on Sarcoidosis. *Am J Respir Crit Care Med*. 1999;160(2):736-755.
3. Stern BJ, Royal W 3rd, Gelfand JM, et al. Definition and Consensus Diagnostic Criteria for Neurosarcoidosis: From the Neurosarcoidosis Consortium Consensus Group. *JAMA Neurol*. 2018;75(12):1546-1553.
4. Langrand C, Bihan H, Raverot G, et al. Hypothalamo-pituitary sarcoidosis: a multicenter study of 24 patients. *QJM*. 2012;105(10):981-995.
5. Rizzato G, Montemurro L, Fraioli P. The kidney in sarcoidosis. *Sarcoidosis*. 1994;11(1):59-61.
6. Blanchard E, M-L E, Brophy M, et al. Chronic Inflammation May Predispose to the Development of Plasma Cell Dyscrasias. *Blood*. 2004;104(11):3650.
7. Kyle RA, Therneau TM, Rajkumar SV, et al. A long-term study of prognosis in monoclonal gammopathy of undetermined significance. *N Engl J Med*. 2002;346(8):564-569.
8. Voulgari PV, tazaridis P, Drosos AA. Association of monoclonal gammopathy of undetermined significance with sarcoidosis. *Rheumatology (Oxford)*. 2001;40(5):596-597.
9. Keijsers RG, Verzijlbergen FJ, van den Bosch JM, et al. 18F-FDG PET in sarcoidosis: an observational study in 20 patients. *Sarcoidosis Vasc Diffuse Lung Dis*. 2008;25(2):141-147.
10. Keijsers RGM, Grutters JC. In Which Patients with Sarcoidosis Is FDG PET/CT Indicated?. *J Clin Med*. 2020;9(3):890.
11. Birnie DH, Nery PB, Ha AC, Beanlands RS. Cardiac Sarcoidosis. *J Am Coll Cardiol*. 2016;68(4):411-421.

Review Article**Dental Implants in Modern Dentistry****Saptarshi Datta****Abstract :**

Dental implants have emerged as a transformative innovation in modern dentistry, offering a permanent and highly functional solution for tooth loss. Once considered a luxury, implants are now widely accepted due to advancements in materials, surgical techniques, and digital planning. This article provides a comprehensive overview of dental implants, detailing their structure, historical development, clinical applications, and future potential.

Typically made from titanium or zirconia, dental implants act as artificial tooth roots that integrate with the jawbone, providing a stable foundation for crowns, bridges, or dentures. Compared to traditional dentures or bridges, implants offer superior comfort, aesthetics, and functionality, while also preserving bone and supporting facial structure.

The implant procedure involves multiple stages — from initial assessment and digital imaging to surgical placement and final restoration. Where necessary, procedures like bone grafting or sinus lifts support long-term success. Various types of implants — including endosteal, subperiosteal, pterygoid, zygomatic, and All-on-4 — are used based on the patient's anatomical and clinical needs.

Digital technologies such as CBCT, CAD/CAM, guided surgery, and robotic assistance have enhanced the precision, predictability, and efficiency of implant procedures. With success

rates over 95%, dental implants are both durable and cost-effective in the long run.

Emerging trends such as bioactive surfaces, smart implants with embedded sensors, and AI-assisted treatment planning are shaping the future of implantology. Dental implants not only restore function and aesthetics but also significantly enhance psychological well-being and quality of life. As innovation continues, implants will become increasingly personalized, accessible, and efficient — solidifying their role as the gold standard in tooth replacement.

Introduction :

Dental implants represent one of the most significant advancements in modern dentistry. Once considered a luxury treatment, they are now a widely accepted and frequently recommended solution for replacing missing teeth. With continual improvements in materials, surgical techniques, and digital planning, dental implants have revolutionized oral rehabilitation, offering patients not only aesthetic restoration but also functional and psychological benefits.

This article delves into the world of dental implants, exploring their development, application in clinical practice, benefits, potential complications, and future prospects.

1. What Are Dental Implants?

Dental implants are artificial tooth roots, typically made from titanium or zirconia, surgically embedded into the jawbone to support a prosthetic

tooth or bridge. These implants serve as a stable and durable foundation for various dental restorations, including crowns, bridges, and dentures.

The typical structure of a dental implant includes:

- The implant fixture : Inserted into the jawbone.
- The abutment: Connects the implant to the final restoration.
- The prosthetic crown or bridge : The visible part that mimics the natural tooth.

2. A Brief History of Dental Implants

The concept of replacing missing teeth dates back thousands of years. Archaeological evidence shows ancient civilizations using materials like seashells, ivory, and carved stones to substitute for lost teeth. However, the modern dental implant emerged only in the 20th century.

In the 1950s, Per-Ingvar Brånemark, a Swedish orthopedic surgeon, discovered that titanium could bond naturally with bone in a process later termed osseointegration. This groundbreaking discovery laid the foundation for modern implantology. The first successful titanium dental implants were placed in the 1960s and have since undergone extensive refinement.

Today, dental implants boast success rates exceeding 95%, and they are a mainstay in restorative and cosmetic dentistry.

3. Why Dental Implants?

To understand the significance of dental implants, it's essential to compare them with other tooth replacement options.

3.1 Traditional Alternatives

- **Dentures** : Removable and often uncomfortable. They may lead to bone loss over time and require periodic adjustments.

- **Dental Bridges** : Fixed but may require the reduction of adjacent healthy teeth, which can weaken them and lead to other dental problems.

3.2 Advantages of Dental Implants

- **Preservation of Jawbone** : Implants stimulate the jawbone, preventing resorption and maintaining facial structure.
- **Durability** : With proper care, implants can last a lifetime.
- **Improved Functionality** : They function like natural teeth, improving chewing, speech, and comfort.
- **Aesthetic Benefits** : Implants look and feel like real teeth.
- **No impact on adjacent teeth** : Unlike bridges, implants don't compromise neighboring teeth.

4. The Implant Procedure : Step by Step

Implant placement is a multi-stage process that can span several months, depending on the patient's oral condition and the type of restoration planned.

4.1 Initial Consultation and Planning

- **Examination** : Comprehensive oral examination including X-rays and 3D imaging (CBCT scans) to assess bone quality and quantity.
- **Medical History** : Evaluation of any systemic conditions like diabetes or osteoporosis that may affect healing.
- **Treatment Planning** : Customized to the patient's needs, often involving digital planning software.

4.2 Tooth Extraction (if needed)

If the tooth is still present and non-restorable, it is extracted. Sometimes, implants can be placed

immediately after extraction.

4.3 Bone Grafting (if needed)

If there's insufficient bone to support the implant, a grafting procedure may be necessary. This can involve:

- Autografts (from the patient's own body),
- Allografts (from donors),
- Xenografts (animal-derived),
- Alloplasts (Synthetic materials).

4.4 Implant Placement

Under local anesthesia or sedation, the surgeon drills a hole in the jawbone and inserts the implant. A healing cap is placed over the implant.

4.5 Healing Period (Osseointegration)

Lasts around 3 to 6 months. During this time, the bone grows around the implant, anchoring it securely.

4.6 Abutment Placement

Once integration is confirmed, the abutment is attached to the implant.

4.7 Crown Placement

Finally, a custom-made crown or prosthetic tooth is attached to the abutment.

5. Types of Dental Implants

Modern dentistry offers several types of implants based on the patient's needs:

5.1 Endosteal Implants

Surgically inserted into the jawbone, these implants support one or more artificial teeth. They're the most common type and suitable for patients with sufficient bone density.

5.2 Subperiosteal Implants

Placed under the gum but above the jawbone.

These implants are ideal for patients with limited bone density or with minimal bone level who cannot undergo bone grafting procedures.

5.3 Pterygoid Implants

These are specialized dental implants placed in the pterygoid region of the upper jaw, specifically anchoring into the pterygoid process of the sphenoid bone and the posterior maxilla. They offer a solution for patients with severe posterior maxillary bone loss, where traditional implants may not be feasible due to insufficient bone volume or proximity to the sinus.

5.4 Zygomatic Implants

These are anchored into the cheekbone (zygoma) via an intra-oral approach. Used in patients with severe upper jawbone loss.

5.5 All-on-4 Implants

A full-arch restoration solution using four implants to support a full set of teeth.

5.6 All-on-6/All-on-8 Implants

These implants provide strong support for full-mouth reconstruction, ideal for patients with multiple missing teeth.

5.7 Mini Implants

Smaller implants used to stabilize dentures or replace small teeth.

6. Materials Used in Implants

6.1 Titanium

- Biocompatible and strong.
- Allows excellent osseointegration.
- Widely used with decades of clinical success.

6.2 Zirconia

- Metal-free, ceramic alternative.
- Hypoallergenic and more aesthetic (white

color) thus gaining popularity among patients with metal sensitivities or aesthetic concerns.

7. Digital Dentistry and Implants

The integration of digital tools has significantly improved the precision and predictability of implant procedures.

7.1 3D Imaging (CBCT)

- Provides detailed visualization of bone and anatomical structures enabling precise virtual treatment planning and optimal implant positioning.
- Helps avoid critical structures like nerves and sinuses.

7.2 CAD/CAM Technology

Allows design and fabrication of crowns, bridges, and surgical guides with high accuracy in single visit.

7.3 Guided Implant Surgery

Uses computer-generated surgical guides to place implants with pinpoint precision. Surgical guides (3D printed) can translate the virtual plan to the patient's mouth — improving accuracy of implant placement (depth, angulation, position) and reducing surgical trauma thus facilitates faster recovery

7.4 Robotic-Assisted Surgery

Offers sub-millimeter accuracy, reducing surgery time and improving outcomes.

7.5 Digital Smile Design

Allows patients to preview their new smile through digital simulations, ensuring their expectations align with planned results.

8. Implant-Supported Prosthetics

Dental implants can support various types of restorations :

8.1 Single Tooth Replacement

One implant supporting a single crown.

8.2 Implant-Supported Bridge

Replaces multiple missing teeth with fewer implants.

8.3 Full-Arch Replacement (All-on-4 / All-on-6/ All-on-8)

Four to eight implants support a full set of upper or lower teeth. These are fixed, permanent solution for edentulous patients.

8.4 Overdentures

Removable dentures stabilized by implants that offer better retention and comfort than conventional dentures.

9. Success Rates and Longevity

Dental implants have a success rate of 95–98% over ten years, depending on factors like:

- Oral hygiene.
- Bone quality and quantity.
- Smoking habits.
- Systemic health conditions.
- With proper care, implants can last 20+ years, and often for life.

10. Risks and Complications

Though rare, implants may face complications:

10.1 Early Complications

- Infection at the implant site.
- Nerve injury or sinus complications.
- Implant failure due to poor primary stability or rejection.

10.2 Late Complications

- Peri-implantitis : Inflammation of the surrounding tissue due to plaque accumulation.

- Bone loss: From chronic infection or overloading.

10.3 Prevention and Maintenance

- Good oral hygiene.
- Regular dental check-ups.
- Avoiding smoking and bruxism (teeth grinding).

11. Cost of Dental Implants

Implants can be costly due to the surgical procedure, materials, and lab work involved. Factors influencing cost include:

- Number of implants.
- Type of restoration.
- Bone grafting or sinus lift procedures.
- Clinic location and expertise.

The cost of dental implants varies depending on factors like location, implant type, and dentist expertise. In India, the cost can range from ₹ 19,900 to ₹ 3,50,000 or more per implant. The average cost of a single tooth implant can range from \$3,000 to \$4,000, while implant-supported bridges can cost between \$5,000 and \$16,000.

Though more expensive initially, implants often prove more cost-effective in the long term compared to dentures or bridges due to their longevity and low maintenance.

12. Psychological, Social and Functional Benefits

Beyond physical restoration, dental implants significantly impact a patient's psychological well-being.

- Improved Chewing Ability: Implants function like natural teeth, allowing for efficient eating and speaking.
- Enhanced Smile: Custom-made crowns match the shape and color of surrounding teeth, boosting confidence.
- Longevity : With proper care, implants can last a lifetime.
- Preservation of Jawbone : Implants stimulate bone growth, preventing shrinkage and maintaining facial structure.
- Easy Maintenance: Implants can be brushed and flossed like natural teeth.
- Improved self-esteem : Due to enhanced appearance.
- A Fixed Treatment option in case of fixed implant prostheses
- Implant Supported Overdentures : Reduced social anxiety from slipping dentures (due to better retention) or gaps.

13. Dental Implants for Special Populations

13.1 Elderly Patients

Contrary to common belief, age alone isn't a contraindication. With good systemic and bone health, elderly patients can benefit significantly from implants.

13.2 Medically Compromised Patients

Patients with conditions like diabetes or osteoporosis may still be candidates, with proper management and precautions.

13.3 Pediatric and Adolescent Patients

Implants are typically avoided until jaw growth is complete (around age 18–20).

14. Future of Dental Implants

The future of dental implantology is promising, with innovations focusing on:

14.1 Bioactive Surfaces

Implants coated with substances such as

hydroxyapatite/bioglass coatings, antimicrobial nanocoatings etc., are being integrated to promote faster bone integration, healing and reduce risk of infection.

14.2 Smart Implants

- Biosensors embedded in implants that detect early signs of infection (peri-implantitis), bone loss or biomechanical overload.
- Remote monitoring platforms: implants communicating data to clinician dashboards to reduce need for frequent physical check-ups.

14.3 Regenerative Medicine

Stem cell and growth factor research may lead to re-growth of natural tooth structures or even gums “regeneration” around implants.

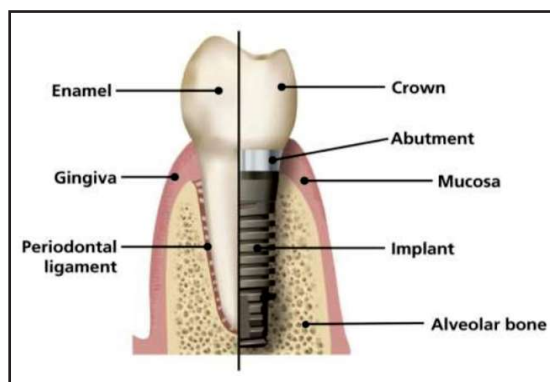
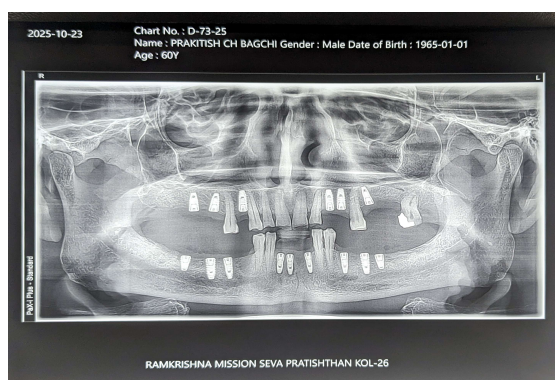
14.4 AI and Robotics

AI is making inroads into many fields of dentistry,

and implantology is no exception. The key applications include :

- Predictive modelling : AI algorithms analysing patient data (bone quality, systemic health, implant position, loading) to predict implant success/failure risk.
- Treatment planning support : Software guiding clinicians in selecting optimal implant size, position and prosthetic design based on vast datasets.
- Automation and workflow optimisation : AI-based segmentation of imaging, automatic surgical guide design, and implant-prosthetic simulation.

By supporting decision-making and reducing human variability, AI can enhance precision, reduce complications and tailor treatments more individually.





Conclusion :

Dental implants have emerged as a transformative

solution in modern dentistry, combining aesthetics, function, and long-term health benefits. They address not only the physical absence of teeth but also the psychological and functional deficits that come with tooth loss. While they require a higher initial investment, their durability, success rates, and patient satisfaction make them a gold standard in tooth replacement.

As technology continues to evolve, dental implants are becoming more accessible, efficient, and customized to individual patient needs. Whether replacing a single tooth or a full arch, implants offer a solution that restores smiles — and lives — with remarkable success.

Reference :

1. Srinivasan M. Digitalization in dental implants. SEEJPH. 2025. <https://www.seejph.com/index.php/article/download/4263/2811/6481>.
2. Haimov E, Sarikov R, Haimov H, Juodzbalsys G. Differences in titanium, titanium-zirconium, zirconia implants: systematic review. J Oral Maxillofac Res. 2023. <https://pubmed.ncbi.nlm.nih.gov/37969951/>
3. Duan X, et al. Survival and success of zirconia vs titanium implants. Clin Oral Investig 2023. <https://pubmed.ncbi.nlm.nih.gov/37740825/>
4. Rousseau N, et al. Local tissue effects of implant surface treatment 2021. <https://arxiv.org/abs/2104.04223>.
5. Chrcanovic BR, et al. Survival of dental implants. J Korean Assoc Oral Maxillofac Surg. 2014. <https://synapse.koreamed.org/upload/synapsexml/3070/jkaoms/pdf/jkaoms-40-50.pdf>.
6. P. D. AI and robotics in dental implantology. SEEJPH. 2025. <https://www.seejph.com/index.php/seejph/article/download/4263/2811/6481>.
7. Brånemark P-I. Osseointegration and history of dental implants. <https://www.branemark.se/history>.
8. Schubert J, et al. Classical osseointegration protocol. Int J Oral Maxillofac Surg. 1990. <https://pubmed.ncbi.nlm.nih.gov/2489290/>
9. Dental Implant OC. Types of dental implants. <https://www.dentalimplantoc.com/types-of-dental-implants>.
10. ZircTeeth. Implant types overview. <https://zirc-teeth.com/blog/types-of-dental-implants>.
11. Nobel Biocare. History of All-on-4. <https://www.nobelcare.com/en-int/news/nobel-biocare-awards-dr-paulo-malo-for-25-years-of-the-all-on-4-treatment-concept>.
12. Titanium implant clinical data. PMC. <https://pmc.ncbi.nlm.nih.gov/articles/PMC11568825/>
13. Zirconia implant survival review. PubMed. <https://pubmed.ncbi.nlm.nih.gov/37969951/>
14. Zirconia vs titanium systematic review. PubMed. <https://pubmed.ncbi.nlm.nih.gov/36330865/>
15. MDPI. Digital dentistry & CBCT review. <https://www.mdpi.com/2306-5354/12/9/927>.
16. Computer-guided implant accuracy study. PubMed. <https://pubmed.ncbi.nlm.nih.gov/31330566/>
17. Bioactive implant coatings research. arXiv. <https://arxiv.org/abs/2104.04223>.