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FROM THE PRESIDENT'S DESK

South Gujarat in the leadership of Surat has not progressed, by leaps and bounds, in economic progress only but in education also! What more to prove that point but a real fine issue of GOA E-Bulletin – Journal that is getting published under the leadership of very hard working and humble Dr. Hari Menon along with contributions from all across South Gujarat.

The issue is presentation of excellence across South Gujarat and the variety of benefits that the patients of that region are enjoying! Equally important is the zest to share the same with fellow members of GOA and others for the benefit of all!

One more thing to be appreciated in particular is absolute discipline and time bound submission of manuscripts by all the contributing authors and that really sets them apart! There is absolutely no delay on part of Guest Editor Dr. HariMenon, nor on the part of any contributors and that thing must be learnt by all! This really sets them apart. And while maintaining the timeline the quality of articles have not been compromised at all; proving the point that discipline and quality are not mutually exclusive!

The variation and choice of articles as well as the contributors speaks tons about the variety that the region has to offer. Right from day to day useful but often neglected consent to day to day humeral fracture to radial tunnel syndrome encompassing DPC, and Q Plasty and Osteonecrosis as well! Really Dr. Hari has put up a great collection of scientific presentations to represent the South Gujarat zone nicely.

Chief editors, as usual are eager to help a great issue each time and both of them Dr. Ketan Shah and Dr. Pareen Kantesaria were busy preparing their manuscript as well as finalization of another issue based upon arthroplasty, still they have pulled together to get this issue published in time and all accolades to them also!

I once again invite all the dignified members to come forward and share your scientific expertise with our colleagues through this excellent scientific platform of GOA. Just be in touch with your zonal representative or any of the office bearers and rest will be taken care of! Have a great scientific fiesta!

Dr. Vijay R. Sata

President, Gujarat Orthopaedic Association
GOA 2024-25

FROM THE DESK OF SECRETARY

Gujarat Orthopaedic Association has climbed a few ladders on the academic forefront by floating the E-bulletins during the last year and half. The scientific contents of the articles included in the bulletins have been world class. It is a tremendous boost to the educational excellence in Gujarat Orthopaedic field.

The quality and quantum of information and knowledge reflects the passion and panache of our members. We always strive to thrive on balanced and optimal representation of all regions and specialties of Orthopaedics. South Gujarat is a melting pot of phenomenal academic and professional work and it is a wonderful opportunity for the stalwarts and young guns in our sphere to showcase their skills and talents through this media where the orbit is continuously expanding.

Dr. Hari Menon, a trusted, seasoned, experienced academician is at the helm as the guest editor of this issue of E-bulletin from South Gujarat. I am sure, with his intuitive and innovative approach, it will be a box office superhit. As always, Dr. Ketan Shah and Dr. Pareen Kantesaria - our commanders- in-chief have further proclaimed their dedication and dexterity to newer heights. I also convey gratitude and gratification towards all the contributors who are the real stars of our galaxy.

In our quest to constantly improve and upgrade our own educational care and share, I urge all our GOA members to read these bulletins and give us your positive, constructive feedbacks, suggestions and criticisms. That would be highly appreciated.

Dr Ketan Thakkar

Secretary, Gujarat Orthopaedic Association
GOA 2024-25

GUEST EDITOR'S MESSAGE

Respected Colleagues,

It is a great privilege for me to write an editorial for the E-bulletin of Gujarat Orthopaedic Association. This time the onus is on South Gujarat to contribute to the Bulletin and I hope we live up to the expectations. It is a proud moment for all our members to hear that our E-bulletin is now being circulated and read in states outside Gujarat. Rather than having a theme based or speciality related article, we have focused on topics that are relevant for the general orthopaedic surgeon.

In this era where filing of Medico-legal cases has become frequent against doctors, it is noted that many times Informed consent becomes vital for the lawyers/ insurers to deny rightful claims or for seeking compensation in alleged negligence cases. Orthopaedic surgeons face a higher risk of malpractice suites as compared to other specialities in Medicine. We have included an article on Informed consent, written by a qualified expert in the field, knowing very well that many of us lack formal training in the exercise and documentation of such consent.

Though case reports are considered of minor importance in evidence-based medicine, they do provide meaningful contribution to knowledge and play an important role in medical education. We have included two case reports that shall provide insights in to diagnosis and management of unusual cases. There are two articles on surgical techniques that shall aid our members in dealing with patients with such conditions. There is also a commentary on Radial Tunnel Syndrome, an entity that could be misdiagnosed with other common conditions. Eminent surgeons who have considerable experience in their respective fields have contributed articles for the Bulletin.

I hope that this article shall prove to be useful and add to the wealth of knowledge already shared through this forum. I thank the Editorial board and President of Gujarat Orthopaedic Association for having faith in entrusting this task in compiling the articles and writing this editorial piece.

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INFORMED CONSENT : PAST, PRESENT & FUTURE

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INTRODUCTION:

In the current scenario, healthcare is an industry, and a doctor functions as a businessperson. Whenever they interact with a consumer (patient), a process unfolds: a proposal (offer) that, when accepted, transforms into a promise. As both parties consider it, it evolves into an agreement (a meeting of two minds), fulfilling Section 10 of the Indian Contract Act and becoming a contract enforced by the law.

Doctors navigate this daily, consciously, or unconsciously. Consent, an integral part, cannot be denied or deviated from. The fundamental practice relies on trust, establishing a relationship between physicians and patients—an unspoken arrangement. Due to uncertainties in outcomes, consent becomes a crucial element involving risk.

The concept of informed consent was pioneered in the US a century ago by Justice

Benjamin Cardozo, stating, “Every human being of adult years and sound mind has the right to determine what shall be done with his own body.” This principle has evolved through the Nuremberg Code (1947), the Declaration of Helsinki (1964), the Belmont Report (1974), and the 1991 establishment.

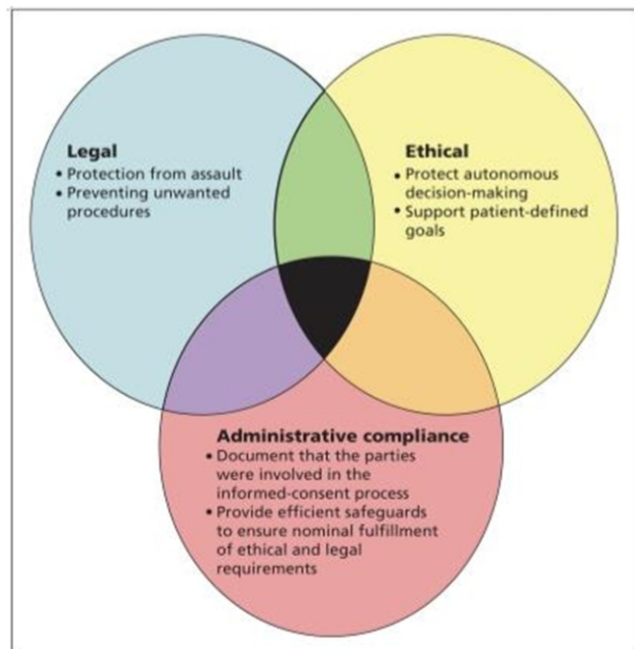


Figure 1:

Venn diagram showing the multiple overlapping purposes of informed consent. PC of Daniel Hall

What factors affecting informed consent?

Several well-documented limitations make informed consent complicated. Constraints like patient's comprehension, patient use of disclosed information, patient autonomy, the demands placed on health

care providers and how well physicians meet the minimal standards for disclosure.

Patient comprehension

Patients often retain minimal information from the informed consent process, with an overestimation of their comprehension. Comprehension levels are influenced by factors like age, education, intelligence, cognitive function, locus of control, and anxiety. The assessment instrument and the topics covered in questions also impact comprehension measurement.

Additionally, comprehension and recall tend to decline as the time between consent and testing increases.

Patients' use of disclosed information

The underlying concept of informed consent assumes that patients will use disclosed information autonomously and rationally. However, this assumption often falls short. While patients share a universal interest in understanding proposed surgical procedures, the level of detail desired varies among individuals. Some prioritize realistic expectations over decision-making, while others approach decisions intuitively or instinctively. Factors such as the hospital's reputation or subjective assessments of surgeons' commitment may also influence decisions. Even when patients deliberate, social pressures within the healthcare system can compromise the efficacy of informed consent, as evidenced by instances where patients felt compelled to sign consent forms against their preferences. In a study on women consenting to gynaecological procedures, 30% did not feel they had a choice about signing the form, viewing it as merely a bureaucratic requirement.

Patient autonomy

Informed consent assumes patients independently exercise their autonomy, but data from within support systems. For instance, a study in Manitoba found that 57%–59% of cancer patients preferred delegating medical decisions. Patient responses on the importance of informed consent often emphasized building trust for a "leap of faith" in the surgeon's care, rather than decision-making. Critics argue that while aiming to protect autonomy, informed consent may paradoxically push patients into decision-making approaches contrary to their preferences and experiences.

Demands on providers Obtaining informed consent in the medical field poses challenges, with the demanding process often overlooked and unrewarded by healthcare administrators. A recent study, using electronic forms for elective surgery consent, found providers spent an average of 10.9 minutes, though variations were significant. Orthopaedic and vascular surgeons showed similar patterns, requiring averages of 16.1 and 12.1 minutes, respectively. These time assessments likely underestimate the actual commitment, excluding discussions pre-surgery. Additionally, achieving informed consent necessitates provider maturity and self-awareness, resisting the temptation to neglect shared decision-making. A study illustrated biases among urologists and radiation oncologists, highlighting the need for vigilance in managing treatment preferences. While removing all bias is impossible, clinicians must transparently base recommendations on clinical experience, acknowledging the nuanced nature of shared decision-making.

Physicians meeting minimal standards

Studies indicate that physicians often fall short of minimal disclosure standards when seeking informed consent. For instance, a study analyzing 1057 physician-patient encounters found that only 9% of the 2553 clinical decisions met the criteria for fully informed decision-making. Despite the widespread belief in the importance of informed consent in medical practice, the reality is that physicians and patients seldom achieve the theoretical ideal.

Qualitative research suggests that both parties primarily perceive the consent process as a means of building trust rather than a tool for decision-making. It is noteworthy that discussions aimed at building trust may differ from those focused-on decision-making.

What actually are we facing? How can we fix it?

Consent is a continuous process that begins when a patient seeks treatment. It is not just a signed piece of paper; rather, it requires a complete understanding of the patient's current situation. This understanding is often lacking. Why? Let us explain. According to the 2021- 2022 survey, the information literacy rate in India is 77%, a generalized figure. India boasts 22 registered languages and around 1599 dialects (boli). With migration for work, diverse cultures, and different zones, the linguistic landscape is complex. English, recognized as a language of opportunity and growth, significantly influences Indian culture, employment, and education. Medical education, for instance, relies heavily on the English language. The lack of medical terminology vocabulary among the general population contributes to the major issue we face. Contrastingly, countries like Germany, Japan, China, and Russia conduct all education in their regional languages. This shields them from understanding issues when explaining medical matters. In India, doctors encounter legal problems due to patient misunderstandings and misinterpretations of their medical issues. In the past, Indian doctors were revered as "God" when their numbers were fewer. Today, with a larger presence, we are under scrutiny, often seen as just a part of window shopping when patients seek help for health troubles. The significant challenge we face is a lack of trust. Developing trust, particularly through an "IC" (Informed Consent), becomes a crucial tool for building trust between us."

Both the legal and ethical aspects of informed consent reflect the shift from physician-centric to patient-centric decision-making. However, there is a growing acknowledgment that in some cases, the emphasis on informed consent might go too far, potentially dictating how patients should exercise their autonomy. To address this concern, there is an increasing focus on a collaborative decision-making process, recognizing the importance of patient input tailored to individual abilities and interests. This approach underscores the significance of the physician's contribution, emphasizing a shared responsibility for decisions in the partnership between patient and clinician. An international consensus panel, as expressed in the "Salzburg statement on shared decision making," advocates for a paradigm shift towards shared responsibility in decision-making among clinicians, patients, and policy-makers.

An alternative perspective argues that informed consent primarily relates to decisions involving the goals of medical treatment. Although not empirically tested, Joffe and Truog posit that rigid interpretations of informed consent blur the distinction between two distinct roles of physicians. They emphasize the significance of eliciting patients' values to facilitate agreement on medical care goals. Once goals are established, the physician, acting as the

patient's fiduciary agent, is then empowered to decide on the technical means to achieve these goals. In practical terms, reaching a clear consensus on treatment goals is considered a crucial step in the informed consent process.

Illiteracy emerged as a notable national concern in India, mirroring findings from the National Literacy Survey (1993), which disclosed that 48% of adults across various sectors in Indian society faced literacy

challenges.⁵ Health care document illiteracy is even more prevalent, with some reports suggesting a 60% incidence;¹¹ individuals who speak regional languages face increased difficulty,¹¹ as do those above the age of 65.¹³ To enhance comprehension, consents for the 6th, 8th, and 12th grades were designed, as recommended by Janofsky et al. Ogloff and Otto proposed that consents be written at a 7th or 8th-grade

reading level, and both they and Hopper et al suggested “trial runs” of consent documents by a lay audience, ideally resembling the study's target profile. Patients often feel hesitant to

disclose their illiteracy to family members or physicians. Joffe et al highlighted that patients' unawareness heightened the “potential for incremental risk of discomfort in the unproven nature of study treatment and uncertain benefits to self. “Patients might not even be cognizant that they are participating in a clinical trial. Coyne et al presented two consents to patients involved in a cancer chemotherapy study – one standard and one “easy to read. “In each group, half of the patients did not comprehend the unlikely prospect of a cure resulting from their participation. Patients also commonly forget information provided by their physicians, with such misunderstandings leading to serious legal consequences for a group of Indian surgeons.

Thoroughly practicing informed consent is intricate, demanding adaptability to fulfil its

diverse objectives. These encompass the legal aim of safeguarding patients' rights, the ethical objective of facilitating autonomous decision-making, the administrative goal of delivering efficient healthcare, and the interpersonal aspiration of establishing the trust necessary for therapeutic interventions. Clinicians bear significant responsibility, especially given the considerable constraints surrounding informed consent. With limited high-quality evidence available, specifically level 1, to guide practice, we provide the following insights to aid physicians in aligning with the ethical and legal ideals of informed consent. These suggestions draw from the interdisciplinary literature reviewed and our own clinical experience in general surgery and internal medicine.

Establish a patient-inclusive decision-making practice that:

- Respects patients' information preferences and decision-making styles consistently for all.
- Systematically addresses risks, benefits, alternatives, and expectations around procedures.
- Ensures the decision-making capacity, voluntary choice, and comprehension of patients or surrogates (e.g., through repetition).
- Explicitly defines and prioritizes care goals in the context of patients' broader life goals, with straightforward goals requiring minimal clarification.
- Adapts discussions to complexity, with more explicit talks for intricate decisions.
- Recognizes the multifaceted purpose of informed consent: legal protection, ethical support for autonomy, administrative efficiency, and building trust.
- Documents thoroughly, preferably using electronic medical records, and adheres to local legal, ethical, and compliance standards through various techniques like consent forms, patient education materials, and narrative notes.

Encourage and check the comprehension:

Promote and assess patient comprehension through various strategies such as decision-making worksheets, user-friendly consent forms, educational programs, multimedia aids, extensive discussions, and testing with feedback. While over 200 decision aids and 34 randomized controlled trials aim to enhance comprehension, results are mixed. A systematic review of 44 intervention trials found success in improving patient comprehension but noted a focus on procedure-related risks over alternatives, benefits, or general knowledge. Efforts to integrate patient-specific risk calculators into consent forms are underway, though their impact remains uncertain. The simple practice of asking patients to repeat information has proven effective in evaluating understanding and enhancing comprehension in several studies.

Goal is to take care and establish the target to provide care:

Crucially, define and prioritize care goals considering the patient's broader life objectives. While common procedures may need minimal clarification, more intricate decisions require explicit discussions. Effective communication of goals is a skill that varies among clinicians, and learning from experienced practitioners during the informed consent process is valuable. Acknowledge that no treatment is risk-free, emphasizing the inherent uncertainty in medical interventions to align with patient expectations. It is essential to establish realistic expectations for treatment outcomes, recognizing that medical terminology may unintentionally convey promises beyond the intended reality.

Good habits of documenting and professional indemnity insurance self-development in certain skills:

Clinicians should diligently document discussions to demonstrate good-faith efforts, recognizing that the diverse purposes of informed consent may necessitate multiple documentation techniques. While standardized forms for administrative compliance may not suit goals of care or trust-building discussions, using various tools can support a robust informed consent process.

For complex decisions like managing breast cancer, decision aids, though less efficient for legal requirements, excel in supporting ethical ideals by defining patient values. Such approaches are being developed for other conditions, though investment considerations apply.

Clear documentation can involve written materials like booklets or procedure-specific consent forms, fulfilling administrative and legal needs. Commercial products and computer-based tools, including online resources, enhance support for clinicians and patients,

improving comprehension and satisfaction. However, assessing “adequate” informed consent remains uncertain.

Audio-visual and multimedia resources contribute to patient education, with 11 out of 15 tools improving comprehension. Despite their effectiveness, developing such tools demands significant time and financial investment.

Professional indemnity insurance for doctors offers several benefits, including:

1. Legal Protection:

It covers the legal costs associated with defending against claims of professional negligence or malpractice.

2. Financial Security:

In the event of a lawsuit, the insurance helps cover compensation payments to the claimant, preventing a significant financial burden on the doctor.

3. Peace of Mind:

Doctors can practice with greater peace of mind, knowing they have financial protection in case of

unforeseen legal challenges.

4. Regulatory Compliance:

In many places, having professional indemnity insurance is a regulatory requirement for medical practitioners.

5. Maintaining Reputation:

Dealing with legal issues can harm a doctor's professional reputation. Indemnity insurance helps manage these situations without compromising the doctor's standing. Overall, it safeguards both the financial and professional well-being of doctors.

A literature review on the impact of news media pressure on doctors highlights several doctors and media outlets can mitigate sensationalism and promote accurate reporting.

Establishing guidelines for responsible health journalism is a recurring theme, emphasizing the need for balanced narratives and contextualizing medical information.

Additionally, findings propose that doctors can proactively engage with media training programs to enhance their communication skills and navigate interviews more effectively.

Collaborative efforts between medical professionals and journalists are also encouraged to ensure accurate representation.

Moreover, the literature emphasizes the role of professional medical organizations in supporting doctors. Developing resources, guidelines, and offering media relations assistance can aid doctors in managing media pressure more effectively. Overall, the literature suggests a multifaceted approach, combining media education, collaboration, and advocacy for responsible reporting to tackle the challenges posed by news media pressure on doctors.

Conclusion:

Research on informed consent lacks clarity and consensus across disciplines regarding its purpose and evaluation standards. Our practical suggestions seek to enhance a genuine effort to involve patients in medical decisions, aligning with the ethical essence of informed consent and reducing legal conflicts. This article addresses crucial aspects of the informed consent process, emphasizing the need to foster trust between researchers and patients. The goal is to support patients in deciding to participate in well-designed clinical trials, ensuring comprehension of risks and values. Challenges such as health literacy, language complexity, and patient understanding may distort perceptions of research trials. While current participants may benefit, the broader aim is to advance healthcare for future patients. We propose specific recommendations to improve the informed consent process, aiming for enhanced patient education, consultation, and understanding of trial risks and values. This, in turn, may increase the enrollment of informed and voluntary patients in well-designed

studies, aligning with the principle of "do no harm." Adequate support for Institutional Review Boards (IRBs) is crucial in overseeing this process and safeguarding patient safety. Key points:

1. The concept of informed consent exhibits variability across contexts, often deviating from its theoretical ideal.
2. Basic consent involves a patient or surrogate, possessing decision-making capacity, freely consenting to a treatment plan aligned with a mutually agreed treatment objective.
3. Consent becomes "informed" when the physician discloses the diagnosis, relevant treatment

options (including the option of no treatment), and associated risks and benefits, ensuring the patient's understanding.

4. Comprehensive documentation of the informed consent process is essential, utilizing electronic medical records, procedure-specific consent forms, patient education materials, and other available options.

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THE FUNCTIONAL OUTCOME OF QUADRICEPSPLASTY FOR POST TRAUMATIC KNEE STIFFNESS IN ADULTS

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INTRODUCTION:

A full range of motion is required for a normal gait and function of the knee, and hence the knee stiffness due to any cause could lead to pain and functional disability. The incidence of post-traumatic extension contracture or knee stiffness is increasing year by year. It is a common complication of lower limb fractures, especially periarticular fractures of the knee, and brings many inconveniences to patients' daily lives. (1)

The site and pathology of lesions in these knees could be either proximal to the knee or within the knee. There could be fibrosis or shortening of the quadriceps muscles (e.g., rectus femoris and vastus intermedius), adhesion of the vastus lateralis to the femoral condyle, or intra-articular adhesions in the patello-femoral or tibio-femoral joint. The knee stiffness could result in a loss in extension or in flexion or combined. The extension loss is usually due to adhesions in the intercondylar notch or tibio-femoral compartments. In contrast, the loss of flexion is mostly due to adhesions in the suprapatellar pouch or the patello-femoral joint, and fibrosis or adhesion of the quadriceps muscles.

There are four basic conditions that cause blockage of knee flexion: fibrosis and shortening of the medial and lateral parapatellar retinaculum, patellar adhesions to the femoral condyles, fibrosis of the vastus intermedius muscle with adhesion of the rectus femoris earlier in the femur, and shortening of the rectus femoral muscle.

If knee stiffness is severe and not improved by conservative management, the functional range of movement can be increased by doing various surgical methods.

The technique of releasing the adhesion and contractures in the quadriceps muscle is known as "QUADRICEPSPLASTY." The surgical principle is based on the release of the extensor mechanism from the adhesions (1)

A modification of range of motion (ROM) of the knee can significantly change a patient's quality of life. In general, ROM of 0 to 125 is adequate for most activities of daily life. Gait analysis has shown that patients require 67 degree of flexion during the swing phase of gait.

Many methods have been used to treat a knee with arthrofibrosis. Bennet first described his method in 1922, followed by Thompson⁴ (1944) and Judet⁵ (1959) and their modifications, described by Van Nes⁶ (1962), Nicoll⁷ (1963), and Hesketh⁸ (1963) and, more recently, many methods have been used to treat a knee with arthrofibrosis. Bennet first described his method in 1922, followed by Thompson⁴ (1944) and Judet⁵ (1959) and their modifications, described by Van Nes⁶ (1962), Nicoll⁷ (1963), and Hesketh⁸ (1963)

Operative Technique

A 6-cm-long median incision is made extending proximally from the superior pole of the patella (Fig 1A), and the rectus femoris is seen generally involved by fibrotic tissue. In the first step, by use of blunt curved dissection scissors, a parapatellar lateral and medial arthrotomy is made by incising the lateral and medial retinaculum, from the top of the patella down the lower pole (Fig 1B).



Fig 1. (A) The patient is placed in the supine decubitus position, and a 6-cm-long median incision is made extending proximally from the superior pole of the patella. (B) In the first step, by use of a blunt curved dissection scissor, a parapatellar lateral and medial arthrotomy is made by incising the lateral and medial retinaculum (yellow dotted arrows), from the top of the patella down the lower pole (right knee)

The second step consists of breaking the adhesions within the suprapatellar pouch and patellofemoral compartment, by use of blunt capsule scissors and sometimes a small osteotome. The third step consists of isolating the rectus femoris from the vastus medialis, vastus lateralis, and vastus intermedius (Fig 2).



Fig 2. Isolation of rectus femoris in a left knee. Once the rectus is isolated, the vastus intermedius tendon is transected adjacent to its patellar insertion

Once the rectus is isolated, the tendon of the vastus intermedius is transected adjacent to its patellar insertion with a scalpel (Fig 3).



Fig 3. Once the rectus is isolated, the vastus intermedius tendon is transected (blue line) adjacent to its patellar insertion with a scalpel; right knee

The fourth step is to release subcutaneous adhesions around the anterior and lateral aspect of the thigh with blunt scissors (Fig 4).\



Fig 4. In the fourth step, subcutaneous adhesions around the anterior and lateral aspect of the thigh are released with a blunt scissor (yellow dotted arrows); left knee

Adhesion sites are shown in (Figure 5).

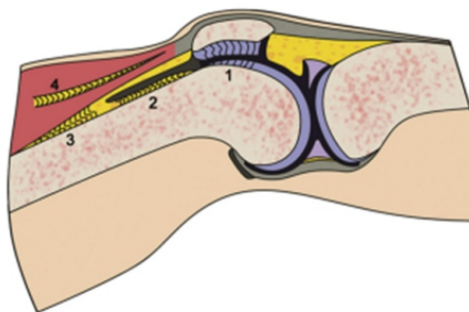


Fig 5. Adhesions on knee: patella (1), suprapatellar pouch and patellofemoral compartment (2), rectus femoris (3), and subcutaneous adhesions (4).

After the aforementioned steps, with the hip in 90 of flexion, gentle manipulation of the knee in flexion is made until maximum flexion is achieved (Fig 6).



Fig 6. With the hip in 90 of flexion, gentle manipulation of the knee in flexion (arrows) is made until maximum flexion is achieved. The surgeon should remember to leave the hip in flexion to avoid complications due to excessive tension on the quadriceps

Our goal is at least 120 to 130. We recommend that the surgeon place his or her index finger on the patellar

tendon during this step so that it is possible to feel any initial ruptures on this tendon. The last step is closure of the skin with heavy nonabsorbable sutures such as Ethibond

Post Op Protocol

A continuous passive motion machine is used for 14 days and encouraged for active and passive knee bending while the patient is supervised by the medical and physiotherapy team. The patient must be seen weekly for the first month and taught how to maintain ROM when physiotherapy is impossible.

Discussion

Quadricepsplasty is a technique of releasing extra articular and intra articular adhesions / contractures which restores useful flexion of the knee joint. Massive soft tissue injury of the anterior thigh, intramuscular injections in the anterior thigh, lengthening procedures involving the femur and other congenital causes of short rectus femoris are all proposed as the possible causes of extension contracture of the knee joint. Judet (4) reported 53 cases in 1959 out of which 45 cases (84.90%) are posttraumatic. The remaining causes were secondary to arthritis, prolonged immobilisation, and patellectomy. Similarly in our study all cases were observed to be posttraumatic most commonly periarticular fractures of distal femur. Many procedures have been described in the literature for treatment of extension contracture of the knee joint. In our study we have analysed the outcome of Modified Judet's Technique of Quadricepsplasty.

An inherent risk of Thompson quadricepsplasty is the possibility of developing extension lag due to insufficient power of rectus femoris to oppose the hamstrings or to maintain extension at the knee as it takes the body weight when walking. Moore et al reviewed nine patients of Thomson quadricepsplasty and reported six cases of mean extension lag of 10° which amounts to 66.66% of patients.

The results of 53 quadricepsplasty done by Judet (4) showed that 11% had extension lag and the majority cases had maximum flexion beyond 100°. In our study 7 patients had undergone Judet's quadricepsplasty, the average pre operative knee flexion achieved is 102.85° and the postoperative flexion is 75.71° which is significantly less compared to original Judet's technique.

In the modified Judet's technique described above maximum cases achieved flexion beyond 100 degrees and there was minimal extension lag. The incision and post operative scar mark is also minimal and the associated blood loss is minimal compared to Thompson and Judet's quadricepsplasty

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PERCUTANEOUS NEEDLE FASCIOTOMY IN DUPUYTREN'S CONTRACTURE

DR.KISHOR DUDHAT M.S.(ORTHO)

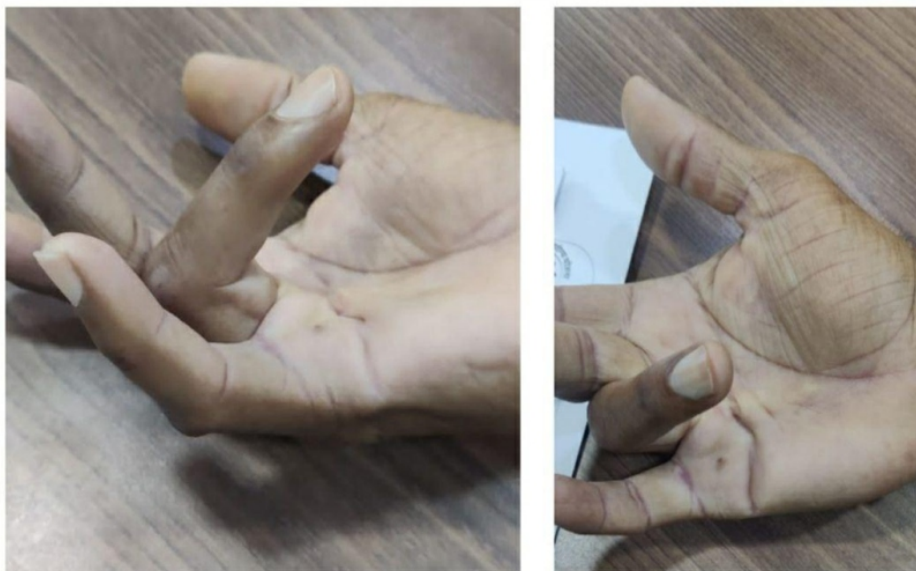
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INTRODUCTION:

Dupuytren disease is predominantly a myofibroblastic disease that affects the palmar and digital fascia of the hand and results in contracture deformities. The most affected digits are the fourth (ring) and fifth (small or pinky) digits. The disease begins in the palm as painless nodules that form along longitudinal lines of tension. The nodules form cords that produce contracture deformities within fascial bands and tissues of the hand.



Dupuytren contracture is a benign disorder of similar etiology to similar disorders such as Peyronie disease, Ledderhose disease, and Garrod disease. Dupuytren contracture is usually seen in whites and the disorder is often bilateral; when unilateral the right side is more likely to be involved compared to the left. In many individuals, there is a family history with males being more likely to be affected than females.

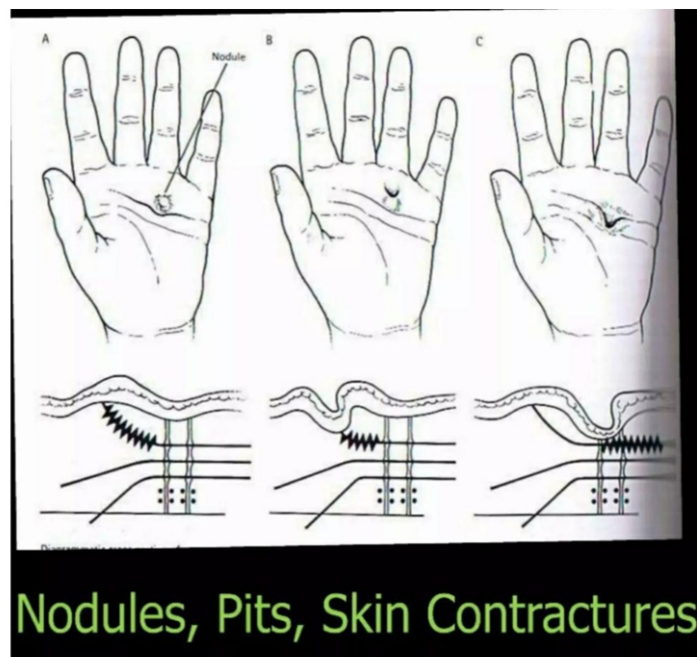
ETIOLOGY

Dupuytren disease is a genetic disorder that often is inherited in an autosomal dominant fashion, but is most frequently seen with a multifactorial etiology. It is associated with diabetes, seizure disorders, smoking, alcoholism, HIV, and vascular disease. Of note, occupation and activities have not been shown to be risk factors. Ectopic manifestations beyond the hand can be seen in Ledderhose disease (plantar fascia), 10% to 30%; Peyronie disease (Dartos fascia of the penis), 2% to 8%; and Garrod disease (dorsal knuckle pads), 40% to 50%.

PATHOPHYSIOLOGY

The pathophysiology of Dupuytren disease involves abnormal myofibroblastic growth in the hand, predominantly composed of type III collagen. Numerous cytokines are involved including interleukin-1, transforming growth factor beta-1, transforming growth factor beta-2, epidermal growth factor, platelet-derived growth factor, and connective tissue growth factor. Dupuytren contracture progresses through three phases: (1) proliferative, (2) involution, and (3) residual. The proliferative phase has a characteristically high concentration of immature myofibroblasts and fibroblasts arranged in a whorled pattern. In the involution phase, fibroblasts become aligned in the longitudinal axis of the hand following lines of tension. In the residual phase, relatively acellular collagen-rich chords remain causing contracture deformity.

The disorder is not always progressive and in at least 50-70% of patients, it may stabilize or even regress.



Transformation of the normal fascial bands into pathological cords is what causes unique deformities of the hand. Central cords originate from the pretendinous bands and cause skin pitting and metacarpal phalangeal (MCP) joint contracture. Natatory cords are responsible for webspace contractures. Spiral cords are the most important in the disease process and can cause proximal interphalangeal (PIP) contracture. A spiral cord originates from four main structures: (1) pretendinous band, (2) spiral band, (3) Lateral digital sheath, and (4) Grayson ligament. Surgeons should be aware that the spiral cord causes displacement of the neurovascular bundle centrally, superficially, and proximally in the digit. Of note, the Cleland ligament and the transverse ligament of the palmar aponeurosis are not involved in Dupuytren disease.

Risk factors for increased severity and recurrence of disease after treatment include male gender, onset before age 50, bilateral disease, sibling/parent involvement, or the presence of Garrod pads, Ledderhose, or Peyronies diseases.

There are also genetic factors involved in Dupuytren disease. In a genome-wide association study (GWAS) of Dupuytren disease by Dolmans et. al. in 2011 identified nine susceptibility genetic loci. Six of these loci contained genes encoding proteins involved in Wnt signaling, including RSPO2, WNT4, and SRFP4. Research has further progressed and now there are 26 known loci described. Additionally, Wnt7b has been found to be expressed in Dupuytren nodules. Much remains to be discovered in our

understanding of the molecular signaling pathways involved in the progression of Dupuytren disease. Future work focused on how changes in Wnt signaling influence stromal cell phenotypes may eventually help to identify new targets for the treatment of disease.

HISTORY AND PHYSICAL EXAMINATION

Dupuytren disease starts as a palpable nodule in the palm, usually at the distal palmar crease. The nodules enlarge into cords and early in the disease, patients may present with just palpable cords along the palm. As the cords thicken and shorten, they cause fixed flexion contractures of the fingers at the MCP and PIP joints. At this stage, patients typically present with loss of range of motion of the hand and palpable cords in the palm extending into the affected digits. Nodules, cords, and finger contractures are pathognomic of Dupuytren disease. Rarely patients report pain.

The 4th digit is most often affected, followed by the 5th digit. Even when the disorder is bilateral, the severity may not be symmetrical. In most cases, palpation of the nodules does not elicit pain unless the ulnar nerve is compressed. Further, the nodules may become tender in the presence of tenosynovitis.

Physical findings:

- Blanching of the skin when the finger is extended
- Proximal to the nodules, the cords are painless
- Pits and grooves may be present
- The knuckle pads over the PIP joints may be tender
- If the plantar fascia is involved, this indicates more severe disease (Ledderhose disease)
- The tabletop test (Hueston) is performed by having the patient attempt to place the palm flat on the exam table. If there is any flexion contracture deformity, the patient will be unable to straighten the fingers, resulting in a positive test.

TREATMENT

Indications for treatment are based on the effects of the disease on the patient's quality of life. Many patients with a positive tabletop test, MCP contracture of 30 degrees, or PIP contracture of 15 to 20 degrees will elect to have treatment.

Treatment options consist of conservative management, needle aponeurotomy, collagenase injection, and/or surgical resection and fasciectomy.

Conservative Management

Observation is appropriate for individuals with painless stable disease and no impairment in function. Follow-up every 6 months may be done to assess the progression of the disorder.

Physical and occupational therapy including ultrasonic waves and heat can help during the early stage of the disease. Some patients may also benefit from a brace/splint to stretch the digits. The range of motion of the fingers is necessary to prevent adhesions.

Corticosteroid injections may be beneficial for some patients, especially those with painful nodules. Unfortunately, the steroid injections do not work in all patients, and recurrence of up to 50% have been reported. More important, corticosteroid injections can lead to fat atrophy, pigmentation change and there is the potential to cause rupture of the tendons.

Other treatments that have been tried include the use of tamoxifen, anti-tumor necrosis factor agents, 5 fluorouracil, imiquimod, and botulinum toxin. There is no evidence that any of these treatments are superior or work for everyone.

Radiation therapy may work during the early phase of the disease only but is also associated with a significant number of complications.

Needle Aponeurotomy

Needle aponeurotomy is typically reserved for mild contractures. The procedure is minimally invasive and is often performed in an office setting. A needle is used to break up the cord. The digit is then manipulated, and the patient wears a night extension splint. Metacarpal-phalangeal joint contractures have the greatest improvement. The benefit of this procedure is that it is minimally invasive and has the potential for immediate results. Disadvantages include iatrogenic injury to nerves and tendons and 58% recurrence rates.



Needle aponeurotomy is an effective, minimally invasive treatment for metacarpophalangeal and interphalangeal joint contractures caused by Dupuytren disease. Multiple joints and digits can be safely treated in 1 session. Needle aponeurotomy is more cost-effective and has a significantly lower complication rate compared with open fasciectomy and collagenase injections. Recurrence rates are higher compared with open fasciectomy and collagenase injections. Patient satisfaction rates are high following needle aponeurotomy; the single clinic visit required and the minimal downtime after treatment are advantages unique to this procedure compared with other treatment modalities, including open fasciectomy, dermatofasciectomy, collagenase injections, and lipofilling.



A technique called percutaneous needle aponeurotomy and lipofilling is described. In a randomized controlled trial, there is no significant difference between this technique and LF after 1 year in contracture correction and recurrent contractures. At 5 years postoperative, however, there is a significant change in recurrence rates in favor of LF. Patients with moderate diathesis should choose between minimally invasive technique with early recurrence, fast recovery, and few complications versus late recurrence, slower recovery, and more complications, as observed with LF or dermofasciectomy.

Skin ruptures are common (5% to 38%) and should not be feared. If a skin rupture occurs, show it to the patient and reassure him or her that this is a well-known complication that will heal by secondary intention within approximately 2 weeks. Do not attempt any other closure of the skin, regardless of the size of the rupture. Apply a compressive dressing and instruct the patient to remove it the next day and to wash the skin rupture with soap and water before applying a simple bandage and continue to do so until healing. If there are doubts about compliance with these recommendations, ensure that the patient is scheduled to have the wound checked in approximately 2 days.



Nerve injuries are rare complications (<0.5%) that occur almost exclusively at the PIP joint level. Use a minimal amount of local anesthetic in the PIP joint and instruct the patient to report any paresthesia so that the risk of damage to the digital nerves is reduced. Tendon injuries have been reported but at a very low rate (<0.05).

Collagenase Injection

Collagenase injections provide a minimally invasive treatment derived from *Clostridium Histolyticum*. The injected enzyme is a metalloprotease that lyses collagen (sparing Type IV collagen which is needed in the basement membrane of blood vessels and nerves). Treatment typically consists of 0.25 mL for MCP and 0.20 mL for PIP contractures delivered subcutaneously directly into the cord with a needle. The affected digit is manipulated under local anesthesia at 24 to 48 hours after injection. Night extension splinting is maintained for 6 months. Collagenase injections have been shown to result in a 75% contracture reduction with a 35% recurrence rate. Complications of injections include edema, skin tearing, tendon rupture, complex regional pain syndrome, and pulley rupture.

Surgery

Surgical fasciectomy can be either partial or total. Partial palmar fasciectomy entails the limited resection of diseased tissue within a ray. Dissection generally is performed from proximal to distal as this usually allows for the identification of neurovascular structures before encountering the spiral cord.

Incisions are customized to each patient in a Brunner zigzag pattern. A V-Y incision and Z-plasty can also be used to lengthen contracted skin. Care must be taken to preserve the neurovascular bundles. The recurrence rate at 1 to 2 years is 30%, 15% at 3 to 5 years, and less than 10% after ten years.

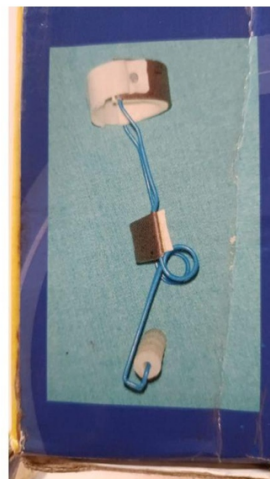
COMPLICATION

Complications of surgical treatment include wound edge necrosis, hematoma, nerve injury, digital ischemia, infection, swelling, recurrence, and postoperative flare. Digital ischemia can be due to direct damage to the vascular supply of the digit or because of stretch injury to vessels in digits with a history of prolonged flexion contracture. As noted, the spiral cord causes central and palmar displacement of the neurovascular bundles, increasing their susceptibility to injury.

Dupuytren flare reaction is pain with diffuse swelling, hyperesthesia, redness, and stiffness. Treatment of this complication consists of steroids, cervical sympathetic block, therapy, and A1 pulley release. There is no increased risk of complex regional pain syndrome (CRPS) if carpal tunnel release is performed with fasciectomy.

REHABILITATION

Postoperatively, patients are entered into hand therapy to help maintain the range of motion of the hand. Extension splints often are used in conjunction with other modalities.



Physical therapy should be undertaken for at least 3 months to prevent contractures. Maximal benefits of surgery are not immediate and only become obvious after 6 to 8 weeks.



Commonly utilized postoperative hand rehabilitation includes regular range-of-motion exercises, scar and edema management, and dynamic vs static splints. These therapy interventions should be started after the inflammatory phase of wound healing, which usually peaks 3 – 5 days post-op. Effective postoperative management is thought to account for up to 50% of overall surgical outcomes, thus underscoring the importance of appropriate therapy.

CO-EXISTING FRACTURE OF THE PROXIMAL HUMERUS AND OPEN HUMERAL SHAFT WITH RADIAL NERVE PALSY-A RARE INJURY

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DR. DAYANIDHI N. DESAI

Abstract:

Ipsilateral Multifocal fracture of the humerus is a rare injury and usually associated with high -energy trauma. We report an unusual injury with co-existing comminuted fractures of the proximal humerus and compound humeral shaft with radial nerve palsy. We discuss our experience in the diagnosis and treatment of a 40-year-old man who was successfully managed with multistage surgeries. At follow up 1.5 years after injury, he was back at work and had a good range of shoulder, wrist, and finger movements. In high energy trauma to the shoulder and arm, unusual fracture patterns with associated neurological deficits may be seen and this case report describes our experience with one such rare injury.

KEY WORDS: Multiple Fractures, Proximal and shaft humerus, radial nerve palsy.

CASE REPORT:

A 40-year-old male patient admitted in hospital within two hours after vehicular accident (fig 1). Patient was unconscious with stable vitals. There was an open wound over the lower third arm from anterolateral aspect to postero-medial aspect (around 20x 3 cm) with exposed bone showing a Gartland-Anderson type III b fracture (fig 2). Radial pulsation was normal. After giving intravenous analgesics and antibiotics, the wound was immediately washed in the casualty department with copious amount of normal saline (3 liters) maintaining all aseptic precautions. Immediately CT scan and x rays were done. CT brain show concussion injury. His x-ray show severely comminuted fracture proximal humerus (NEER TYPE IV) with comminuted fracture shaft humerus (fig 3,4). The patient was immediately taken to the operation theatre. The wound was irrigated with low pressure pulsatile manner with more than 6 Liters of Normal Saline, followed by debridement of the unviable tissues. Two cut ends of radial nerve found. Wound look good so shaft fracture fixed with 4.5 mm DCP, 4.5 mm cortical screws with one interfragmentary screw. Primary wound closure was done with drainage tube (fig 5). Proximal humerus fracture fixed with Joshi's external stabilizing system (JESS FIXATOR) (fig 6). In proximal fragment six K-wires were put in different planes, in shaft three K-wires put and a delta frame was made. The patient was discharged after five days and intermittent elbow mobilization encouraged. Stitches were released on the 14th post operative day. The frame was kept for 3 months (fig 7). On sequential x rays, no radiological sign of union seen on shaft part, so after 4 months post operative period - fixator removal, bone grafting in shaft humerus and radial nerve grafting was planned. Nerve Auto graft taken from sural nerve by plastic surgeon. 4.5 mm locking DCP was added to stabilize shaft fracture with bone graft. Shaft fracture united within 6-8 weeks (fig 8). Radial nerve function recovered within 6-9 months post graft. Patient had good shoulder and wrist function within 18 months of primary injury (fig 9).



Fig1:atthetimeofaccident



Fig2:Woundappearance:Atthetimeofadmission



Fig3:X-RayAp-Lat:Atthetimeofadmission

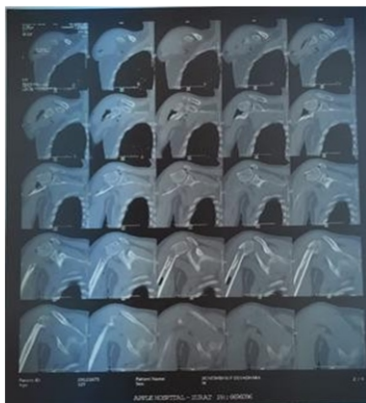


Fig4:CT-scan:Atthetimeofadmission

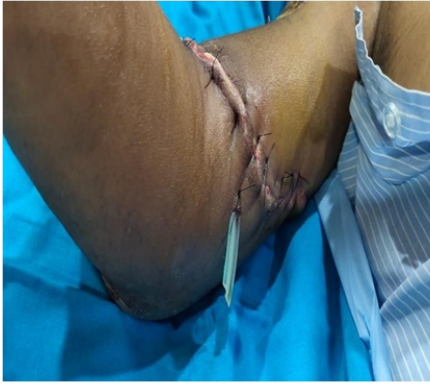


Fig5:closureofwoundwithdraininsitu

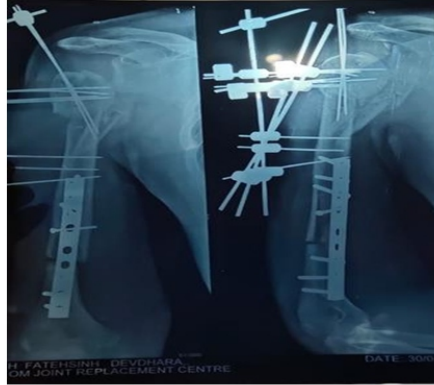


Fig6:postOPX-Rays

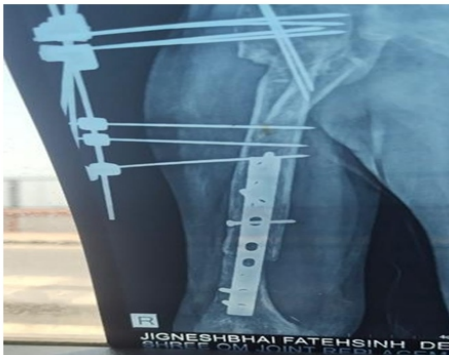


Fig7:3monthspostOPX-Ray

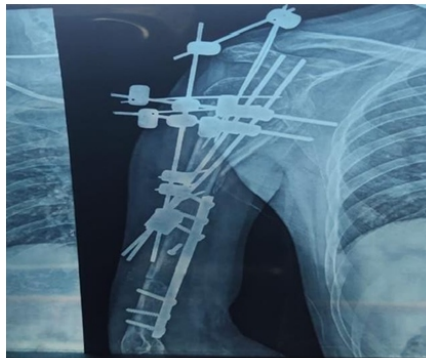


Fig8:2.5years postopX-Ray

Discussion:

- The comminuted proximal humerus fracture, compound fracture shaft humerus with radial nerve injury is rare. In young adults, it is usually because of high energy trauma. Such fractures have been treated with a wide range of options- namely non operative, open reduction and internal fixation, external fixation, closed K-wire fixation. Each procedure has some limitations and complications.

- The use of external fixator in the management of proximal humeral fractures has begun to gain acceptance over the last twenty years. The idea of minimal fixation now lends to the fact that the blood supply to the head of humerus is preserved. The smaller K- wires used in JESS have less risk of soft tissue, neural and vascular injury. Multiple K- wires used in different planes add to the rotational stability to a reduced fracture. The principal of management for complex proximal humeral fracture is minimal soft tissue dissection to avoid the occurrence of avascular necrosis of humeral head, adequate fixation to provide good stability for early rehabilitation and an intact rotator cuff for an optimal functional outcome. Closed reduction and use of JESS achieved these principles adequately.

- In our case, because of the presence of severe comminution internal fixation was not feasible. Internal fixation has been reported more complication due to hardware loosening and increased risk of avascular necrosis. JESS fixator application in our case allowed sound fracture union.

- Good to excellent motor recovery can be expected in 83% of patients who have a large gap of radial nerve when sural nerve auto graft is used. Advantage of sural nerve graft are easy and quick harvest, straight course with minimal branching, high number of fascicular groups and low donor site morbidity. The recovery time for a radial nerve graft is between six months to one year.

Clinicalphotos



Fig-9 Movement of shoulder and wristjoint

CONCLUSION:

- Ipsilateral multifocal fracture of the humerus is a rare injury which needs proper surgical planning for a better result. JESS used in the management have less risk of soft tissue, neural and vascular injury. Radial nerve graft has a good recovery rate.

OSTEOARTHRITIS OF HIP SECONDARY TO OCHRONOSIS

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Abstract:

Alkaptonuria is a rare disorder of tyrosine metabolism, characterized by the excretion of homogentisic acid with urine, which causes darkening when exposed to air and the deposition in certain tissues, especially in joint cartilage. Ochronosis or ochronotic arthropathy, first described by Virchow in 1866,¹ demonstrates a rare expression of alkaptonuria. In our case report we report a case of 71 year old male patient with osteoarthritis of right hip who was treated with right total hip replacement during which we had found severe osteoarthritis with blackish discolouration of femoral head, acetabular cavity and surrounding tendons and tissue. Patient was diagnosed with alkaptonuria based on clinical and laboratory investigations

I. Background

Alkaptonuria is an extremely rare metabolic disease and is defined as an autosomal recessive inherited deficiency of the hepatic enzyme oxidase of the homogentisic acid^{1,2} (Figure 1). Deficiency of the enzyme causes accumulation of the homogentisic acid in the cells and the body fluids. The disease is characterized by the following three specific conditions, excretion of homogentisic acid in the urine, arthritis and ochronosis. Homogentisic acid accumulates and is polymerized into a blue-black pigment that is ultimately deposited in the skin, cartilage and collagenous tissues. Specifically, pigment deposition can be seen in skin, bones, articular cartilages, ear and sclera, heart endocardium and valves, and kidneys (the so called ochronosis).³ The accumulation eventually causes severe degeneration of the spine and peripheral joints, like knees, hips and shoulders.

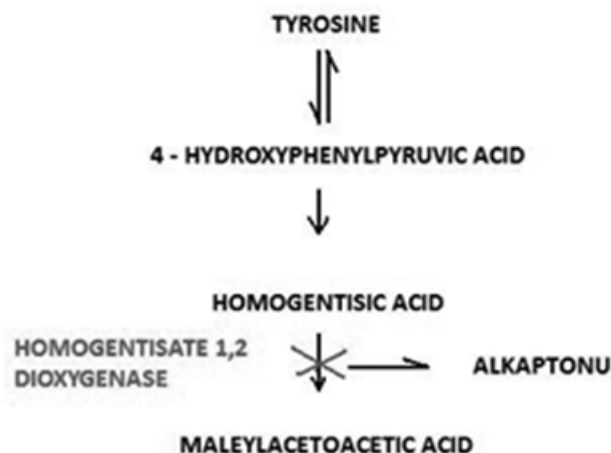


Figure 1 The catabolic path of tyrosine. Deficiency of the hepatic coenzyme oxidase of the homogentisic acid causes alkaptonuria due to the accumulation of homogentisic acid.

I. Case Presentation

In our case a 71 year old male who presented to our out patient department with complain of persistant right hip pain with difficulty in walking at sleeping, patient did not suffer from any chronic disease and was not on any medication on regular basis.

On clinical examination patient had severe pain on flexion,extension internal rotation and external rotation of hip. Patient also had bilateral lower limb edema for which USG guided Doppler study of right lower limb was advised which was suggestive of bilateral lower limb stasis and multiple perforaterincompetance. Patient was then subjected to radiological investigation which revealed severe osteoarthritis of right hip.

On general overview of patient , patient had blackish pigmentation of sclera and blackish pigmentation of skin over hand and foot,andxray of patients spine showed calcification of disc so we sent patients urine samples for Urinary Homogentisic acid which was positive.

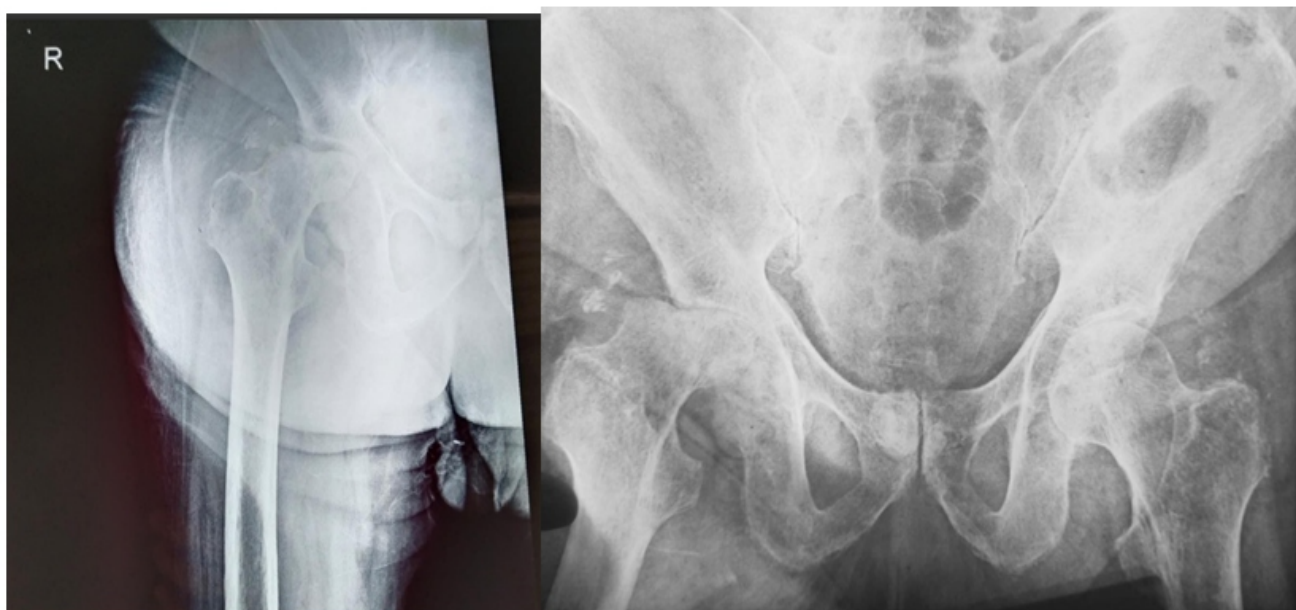


Figure 2: Radiographs suggestive of right side osteoarthritis of hip

Patient was then after primary investigations posted for right sided total hip arthroplasty,during the surgical approach we observed dark pigmentation of synovium,femoral head, acetabular cavity and tendons inserting over the greater trochanter of femur.we performed a right total hip replacement and sent the soft tissue and femoral head for histological examination.

Histological and laboratory diagnosis confirmed the diagnosis of ochronotic arthropathy/ Alkaptonuria.



Figure 3: Blackish discolouration of femoral head

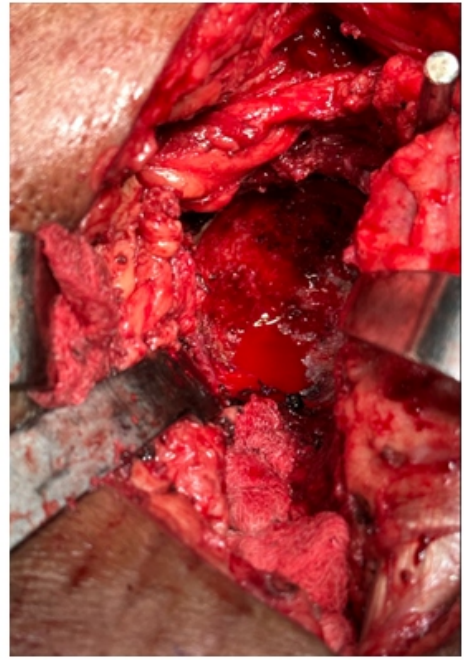


Figure 4: Black discolouration of acetabular cavity



Figure 6: Black pigmentation of face and sclera



Figure 7: Black pigmentation on over hand

I. Outcome And Follow-Up

Patients post operative period was uneventful and was started on physiotherapy and The patient walks normally and without the help of crutches, performs complete flexion and extension of the knees and complete movements of the right hip not accompanied by pain during the flexion, internal and external rotation. Comparison of the length of the two extremities showed no difference, the patient did not mention any pain in daily life activities

II. Discussion

The ochronotic arthropathy is a common expression of alkaptonuria, an extremely rare metabolic disease, defined as an autosomal recessive inherited deficiency of the hepatic enzyme 'oxidase of the homogentistic acid'. Patients with alkaptonuria are usually free of symptoms in childhood and adolescence, however the hyper pigmentation of the urine can be observed even in childhood. A percentage of 25% do not present dark hue of the urine and, thus, many patients with ochronosis remain undiagnosed until adulthood. The insufficiency of sucrose – isomaltase as well as the neonatal hyperparathyroidism can be inherited together with alkaptonuria. Ochronosis can be exogenous, induced by several harmful substances such as phenol, trinitrophenol, benzene and hydroquinone. In exogenous ochronosis the arthropathy observed in alkaptonuria is absent.

Ochronotic arthropathy appears usually during the third or fourth decade of life and is more severe in males. It has been suggested that clinical manifestations of alkaptonuricochronosis are usually delayed, not appearing until the fourth decade of life because with ageing the renal clearance of homogentistic acid decreases.¹⁴ Mild and extremely rare, extensive ochronotic arthropathy has been reported in children. The most frequent manifestations of the disease are diffuse calcification of the intervertebral disk followed by narrowing of the intervertebral space and specific type of arthropathy of the axial skeleton and the peripheral joints. Peripheral arthritis is observed in almost all patients, as they grow in age. It first appears in knees, hips, shoulders, seldom in small joints of hands, and it is manifested by pain, limited morbidity and hydrarthrosis. Bibliography mentions appearance of intervertebral disc herniation as well as spontaneous tendon rupture both as first manifestations of the disease.

Apart from the musculoskeletal system, alkaptonuria affects other systems, such as cardiovascular, by secondary calcification of the aortic valve, being probably so severe that requires urgent replacement of the aortic valve, aortic stenosis and ischemic heart disease, leading to myocardial infarction. Nevertheless, there are references mentioning attack of the urinary system with the presence of swelling and calculus of the prostate, nephrolithiasis, renal failure, usually in late stages, as well as attack of the respiratory system with the appearance of throat dryness, dysphagia and dyspnea.

Until now, no specific therapy has been found. The recommended therapy is the reduction of the intake of phenylalanine and tyrosine and the increase of the intake of ascorbic acid, without strong clinical evidence. The destruction of the cartilaginous joint surfaces is extensive and appears at a young age, so that the patient requires a total arthroplasty before the age of 60. The total arthroplasty constitutes the unique solution to improve the quality of life for those patients.

Total joint replacement in published cases of ochronotic osteoarthritis report good results similar to osteoarthritic patients without ochronosis. Because all these are reports, no guideline is available for replacement of the knee or hip joints in ochronotic patient. In our review of the world literature we found very few studies upon the subject of early loosening of the arthroplasty in patients with ochronotic arthropathy. Spencer et al.²⁸ reported that they met no complication following arthroplasty on 11 joints of 3 patients diagnosed with osteoarthritis attributable to ochronosis. They reported no implant deficiency including total hip arthroplasty or any problem in 12 years follow up period. As in the whole spectrum of the metabolic bone diseases, the potential of early failure of the arthroplasty is increased. In our research in the literature, we found no reports mentioning cases of revision of knee and hip arthroplasty.

Kotela et al.[17]	2008	59/M	Bilateral Knees	Cemented	---	Good
Kefeliet al.[18]	2008	60/F	Bilateral Knees	Cemented	10 Months	Good
Araki et al.[19]	2009	56/M	Bilateral Knees	Cement less	---	Good
Babak Siavashiet al.[20]	2009	54/F	Right Hip	Cemented	---	---
Fontao - Fernandez et al.[21]	2010	68/F	Left Knee	---	---	Good
Abimbola et al.[22]	2011	48/M	Left Knee	Cemented	2 Years	Excellent
Varvitsiotiset al.[23]	2014	53/M	Bilateral Shoulder	---	6 Years	Good
A.Malakasi et al.[24]	2012	77/M	Right Knee	Cemented	---	Good
Mehmet Ali Acar et al.[25]	2013	62/F	Right Hip and Left Knee	Cemented hip and cement less knee	18 Months	Good
Ramadan eat al [26]	2013	69/M	Bilateral Knees	Cemented	1 year	Excellent

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RADIAL TUNNEL SYNDROME

AN OVERVIEW OF A FREQUENTLY MISDIAGNOSED COMPRESSIVE NEUROPATHY

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Abstract:

Radial tunnel syndrome refers to a compressive neuropathy of the posterior interosseus nerve (PIN) in the radial tunnel. Radial tunnel syndrome is a more controversial diagnosis. This a pain-only pathology, as opposite with PIN compression syndrome, which describes a more severe PIN compressive neuropathy. Symptoms of pain and weakness may be reported by patients after activities of forceful elbow extension or forearm rotation. The forearm pain typically localizes to the lateral aspect of the forearm, and weakness is often secondary to the pain. Lateral epicondylitis must be considered in the differential diagnosis. Both lateral epicondylitis and radial tunnel syndrome can occur simultaneously. The tendinous origin of the extensor carpi radialis brevis can be implicated in both conditions. Treatment is usually conservative, with surgical radial tunnel release reserved for recalcitrant cases.

Introduction:

ANATOMY OF RADIAL TUNNEL- The radial tunnel begins anterior to the radiocapitellar joint and is approximately 5 cm in length. The tunnel is formed laterally by the extensor carpi radialis longus and brevis and the brachioradialis muscles, medially by the biceps tendon and brachialis, and posteriorly by the radiocapitellar joint capsule. The brachioradialis muscle passes over the nerve in a lateral to anterior direction to form the roof of the tunnel. The radial tunnel ends at the arcade of Fröhse, compressive tendinous bands have been described that extend to the distal end of the supinator muscle.

RADIAL NERVE COURSE-

The radial nerve enters the forearm anterior to the lateral epicondyle and then divides into the superficial and deep branch (posterior interosseous nerve). The extensor carpi radialis brevis is generally innervated distal to the elbow joint from either the posterior interosseous nerve or the superficial radial nerve. The posterior interosseous nerve passes under the arcade of Fröhse before passing between the two heads of the supinator. The arcade of Fröhse is a fibrous arch that originates from the lateral epicondyle and in a number of cases has a tendinous consistency. Fibrous bands within the supinator muscle or hypertrophy of the superficial head may cause compression in this location. After exiting the supinator muscle, the posterior interosseous nerve then divides into deep and superficial branches. The superficial branch innervates the extensor carpi ulnaris, extensor digitorum communis, and extensor digiti quinti muscles. The deep branch innervates the abductor pollicis longus, extensor pollicis longus, extensor pollicis brevis, and finally, the extensor indicis proprius muscle.

Causes for Radial tunnel syndrome:

Radial tunnel syndrome can be common in individuals who have:

A history of overuse in a single event or repetitive activities

A history of rotation of the forearm activities

A history of tight-grip activities

Clinical evaluation:

Radial tunnel syndrome is a clinical diagnosis based on tenderness over the radial tunnel. Patients are tender to direct palpation over the mobile wad of the forearm with the point of maximum tenderness 2 to 5 cm distal to the lateral epicondyle of the humerus. This area of point tenderness is the primary finding in radial tunnel syndrome on physical examination. Because reproduction of pain with deep palpation is important in making this diagnosis, it is important to test the contralateral asymptomatic arm. Pressure is placed over the posterior interosseous nerve in the interval between the brachioradialis and extensor carpi radialis brevis muscles, and the patient's response is compared between the two forearms. Because this is a subjective diagnosis, it is important to check the patient's pain response at nonentrapment sites and to re-examine the patient on a few occasions. Radial tunnel syndrome is often difficult to distinguish from lateral epicondylitis or tennis elbow and represents concomitant pathology in 5% of cases. Commonly performed tests for diagnosis in a patient with RTS are –

- Rule of 9 test - Loh et al described this test for non-specific elbow pain in 2004
- Maudsley's test - Resistance to active extension of third finger results in pain around the elbow.
- Resisted supination test - It is performed with elbow in extension and forearm in pronation. Patient is asked to actively supinate the forearm while maintaining elbow in extension. Resistance is given at wrist against active supination. It is often positive in patients with lateral epicondylitis
- Cozen's test - Resistance provided to the wrist dorsiflexion with elbow in extension and forearm in pronation results in pain
- Mill's Manoeuvre - While palpating the lateral epicondyle, the elbow is extended with forearm in pronation followed by passive volar flexion of the wrist

Diagnosis:

diagnosis can be difficult as the provocative tests are nonspecific.

Magnetic resonance imaging (MRI), has a limited role in diagnosing radial tunnel syndrome as it is often negative. MRI is useful, however, to evaluate common locations of PIN entrapment and to identify other causes of compression such as tumors, ganglion cysts, or heterotopic ossification.

Electrodiagnostic studies are also negative as the large myelinated fibres of the PIN are not affected. Again, these studies can be used to rule out other causes of neuropathy, such as foraminal stenosis in the cervical spine. Kupfer et al. measured differences in motor latency in forearm neutral, supination, and pronation positions.

Ultrasonography is a useful tool in detecting the thickening of supinator edge, ECRB thickening, space occupying lesion in the radial tunnel, radio-capitellar arthritis and diameter of the nerve.

dynamic ultrasound during different positions of forearm can detect early nerve compression in patients suspected with RTS.

Treatment:

There is no specific nonoperative treatment of radial tunnel syndrome. However, nerve gliding exercises may be useful. Other non-operative treatment includes splinting, non-steroidal anti-inflammatory drugs, and local steroid injection in the radial tunnel. In patients with concomitant lateral epicondylitis, therapy may improve the symptoms associated with lateral epicondylitis. Tennis elbow straps are not recommended for patients with radial tunnel syndrome because of the increased pressure that may be placed on the radial nerve.

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Surgical treatment: The principle of surgical decompression is to release all the possible sites of compression of PIN in the radial tunnel. The PIN should be carefully explored and all possible sources should be released.

Several approaches (anterior, posterior, and trans muscular brachioradialis splitting) have been described for release of the posterior interosseous nerve based on the relationship of the incision to the brachioradialis muscle.

1. Trans muscular Brachioradialis-Splitting Approach - longitudinal or "S"-shaped incision is made beginning proximal to the radial head and 3 cm lateral to the biceps tendon. The fascia over the brachioradialis muscle is incised and the muscle belly is split bluntly while aiming for the radial head until the fat overlying the radial nerve is seen. The brachioradialis muscle split is lengthened over the radial tunnel. Transverse vessels are coagulated, and the fibrous bands overlying the posterior interosseous nerve and the fibrous edge of the extensor carpi radialis brevis are divided. Recurrent radial vessels are ligated and the superficial head of the supinator muscle is divided completely.

2. Posterior (Henry or Thompson) Approach - The forearm is pronated and a 10-cm straight skin incision is made along an imaginary line extending from the lateral epicondyle to Lister's tubercle. The forearm fascia is incised in the interval between the extensor digitorum communis and the radial wrist extensors. The supinator is identified deep to the extensor muscles in the proximal third of the incision. The posterior interosseous nerve can then be found at the proximal edge of the supinator, and the fibrous leading edge of the extensor carpi radialis brevis and the tendinous leading edge of the supinator are released. The recurrent leash of the vessels of Henry is ligated.

3. Anterior (Modified Henry) Approach - A curvilinear incision is made starting above the lateral humeral epicondyle and continuing distally between the biceps and brachioradialis muscles and then curving laterally 2 cm above the elbow flexion crease, back over the mobile wad, and medial to the ulnar border of the brachioradialis muscle. The fascia divided along the brachioradialis muscle, which is then retracted laterally while retracting the biceps and pronator teres in the distal wound medially. The radial nerve is identified in the interval between the brachialis and brachioradialis and then followed distally. Fibrous bands overlying the posterior interosseous nerve and the fibrous leading edge of the extensor carpi radialis brevis muscles are divided. The recurrent radial vessels of Henry are ligated and the arcade of Fröhse is released. The mobile wad is elevated and retracted to visualize the entire length of the supinator. The superficial head of the supinator is divided to expose the nerve to its terminal branches.

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