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Suture Materials to Reduce the Sinus Tract Formation in Caesarean Section

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Abstract

Caesarean section plays a crucial role in the provision of comprehensive emergency obstetric and neonatal care, and its prevalence has been rising globally in recent times. The proper healing of the scar following a caesarean section is critically important to prevent various obstetrical complications in subsequent pregnancies. The standard method for closing the abdominal wall must be implemented with careful consideration to ensure adequate support, prevent infections, avoid sinus formation, and mitigate incision pain and scar dehiscence. Numerous sutures and suturing techniques are utilized globally for the closure of abdominal layers after a caesarean section. wide range of materials and techniques are employed for skin closure following a caesarean section, and it is essential to determine which methods yield the most favourable outcomes for women.

Obstetricians frequently utilize synthetic absorbable sutures for uterine closure during caesarean sections. This research paper seeks to evaluate the effects of different synthetic absorbable and non-absorbable suture materials on the development of caesarean scar defects. Additionally, a case report is analysed, detailing a typical instance of multiple chronic discharging abdominal wall sinuses associated with Prolene granuloma in a 41-year-old woman following a caesarean section.

Keywords: Suture material, Prolene granuloma, abdominal wall sinuses, chronic discharging tracts, foreign body material

1. Introduction

In worldwide many countries the Caesarean section is among the most frequently conducted abdominal surgeries on women. In recent years, its prevalence has significantly risen, in the developed nations with approximately 20–25% of all childbirths. The increasing rates pose a significant concern for public health professionals because of the related health risks for both mothers and infants when the procedure is not medically justified. A range of surgical methods for all aspects of the caesarean section procedure are currently employed. However, to get an improved outcome the techniques should be thoroughly assessed in randomized controlled trials. There is insufficient evidence to determine whether any specific method for closing the abdominal wall during a caesarean section is superior to others. Given the high number of women undergoing caesarean sections, even minor variations in post-operative morbidity rates resulting from different techniques could lead to enhanced health outcomes for a significant number of women, as well as considerable savings in healthcare costs and resources. Globally, the rates of caesarean sections have increased from approximately 7% in 1990 to 21% at present, with expectations of further growth throughout this decade. Should this trend persist, projections indicate that by 2030, the highest rates will likely be found in Eastern Asia (63%), Latin America and the Caribbean (54%), Western Asia (50%),

Northern Africa (48%), Southern Europe (47%), and Australia and New Zealand (45%), according to the research [1].

Table 1: Caesarean section rates in 2018 as per the United Nations geographical grouping

Asia (n=40)	23.1 (19.9, 26.3)
Western Asia (n=15)	31.7 (22.7, 40.6)
South-eastern Asia (n=8)	15.9 (9.6, 22.3)
Southern Asia (n=7)	19.0 (13.7, 24.3)
Central Asia (n=5)	12.5 (6.5, 18.4)
Eastern Asia (n=5)	33.7 (27.3, 40.1)

Suturing plays a crucial role in ensuring a healthy recovery for patients undergoing surgery. They are medical instruments designed to bring two soft tissues together and maintain their position until they naturally unite. Sutures have a thread-like composition and are available in various shapes and sizes. There are mainly two categories of sutures: absorbable and non-absorbable. As indicated by their name, absorbable sutures are gradually absorbed by the body, whereas non-absorbable sutures require removal by a physician. Non-absorbable sutures consist of materials that are resistant to enzymatic breakdown and must be extracted by a doctor once the wound has healed. Failure to remove them in a timely manner can result in complications such as excessive scarring, an increased risk of infection, the development of abscesses, or the occurrence of a stitch sinus.

In caesarean the main objectives of wound closure encompass the elimination of dead space, the uniform distribution of tension along deep suture lines, and the preservation of tensile strength throughout the wound. The aim is to secure sufficient tissue tensile strength following the approximation and eversion of its epithelial layer. staples, tape, adhesives, and sutures were the various methods utilized for mechanical wound closure during caesarean section.

Table 2: Types of suture material used in Caesarean section

Feature	Sutures (Subcuticular)	Staples (Metal)	Tape (Steri-Strips)	Adhesives (Glue)
Common usage	Standard practice for C-section skin closure	Urgent C-sections, high-tension areas	Support after suture/staple removal	Small, low-tension incisions; sometimes for C-section skin
Speed of closure	Slower than staples	Very fast	Very fast (support)	Fast
Wound complications	Lower risk of wound separation	Higher risk of wound separation	Lower tension when used as support	Possibly higher risk of dehiscence

Cosmetic outcome	Often results in a better cosmetic scar	Can lead to more visible "railroad track" scars	Can help improve final scar appearance	Comparable to sutures
Post-operative pain	Comparable to staples	Removal can be uncomfortable	Minimal impact	Possibly less pain than sutures
Removal required	No (absorbable)	Yes (manual removal)	No (peels off over time)	No (peels off over time)

Each technique possesses distinct indications, benefits, and drawbacks. Suture closure facilitates primary wound healing as the tissue is maintained in close proximity until adequate healing has transpired to endure stress without mechanical assistance. The suture material, being a foreign entity introduced into human tissue, provokes a foreign body tissue response. During the process of wound closure, maintaining a sterile field and employing a meticulous aseptic technique are essential to reduce the likelihood of wound infection. During this caesarean section's women experience a phase of postoperative pain along with a period of morbidity. Employing the correct technique for approximating the wound post-caesarean section can not only alleviate financial strain but also facilitate the patient's immediate recovery.
In the caesarean section mainly, the complications associated with wound healing, such as hypertrophic scars, broad scars, and wound dehiscence, may arise from patient-related factors, including nutritional status, inappropriate suture selection, or a technique that imposes excessive tension across the wound.

2. Selection of suture material

Classification of Suture Materials Broadly speaking, sutures can be categorized into absorbable and non-absorbable materials. They can be further divided into synthetic or natural sutures, as well as monofilament or multifilament sutures. The ideal suture should be as small as possible to ensure uniform tensile strength, securely hold the wound for the necessary healing duration, and then be absorbed. It ought to be predictable, easy to manipulate, cause minimal reaction, and form secure knots. The choice of suture type largely depends on the clinical situation.

There are mainly two categories of sutures: absorbable and non-absorbable. As indicated by their name, absorbable sutures are gradually absorbed by the body, whereas non-absorbable sutures require removal by a physician. Non-absorbable sutures consist of materials that are resistant to enzymatic breakdown and must be extracted by a doctor once the wound has healed. Failure to remove them in a timely manner can result in complications such as excessive scarring, an increased risk of infection, the development of abscesses, or the occurrence of a stitch sinus.

Absorbable sutures: The absorbable sutures are decomposed by the body through enzymatic reactions or hydrolysis. The duration of this absorption process varies based on the material, the location of the suture, and individual patient factors. Absorbable sutures are typically employed for deep tissues and those that heal quickly; consequently, they may be utilized in small bowel anastomosis, suturing within the urinary or biliary tracts, or ligating small vessels near the skin.

1.Vicryl rapide suture= 42 days

2.Vicryl suture= 60 days

3.Monocryl suture= ~100 days

4.PDS suture = ~200 days

Non-Absorbable Sutures serve the purpose of providing long-term support to tissues, remaining isolated by the body's inflammatory responses. Their applications include use in tissues that have a slow healing process, such as fascia or tendons, the closure of the abdominal wall, or vascular anastomoses.

Silk sutures: Silk sutures have been utilized globally since the 1890s. Their soft texture allows for easy handling by surgeons; they possess excellent knot-tying capabilities and typically do not provoke allergic reactions. Despite being classified as non-absorbable, silk sutures generally degrade within two years. Additionally, their tensile strength is relatively low, making them prone to breaking under high tension. Silk sutures are primarily employed for mucosal tissues or for closing intertriginous areas, making them particularly suitable for dental surgery.

Polyester sutures: Polyester sutures exhibit superior tensile strength compared to silk and are highly effective for moist tissue ligation. They provide long-term support for wounds and are inherently non-absorbable. This type of suture material is commonly used in orthopaedic surgeries, cardiac procedures, and surgeries involving nerve and tendon repairs.

Stainless steel wire sutures: Stainless steel wire sutures are utilized in orthopaedic operations and sternum closures. A key advantage of these sutures is their sterility, which eliminates the risk of infection. These soft and malleable sutures offer optimal strength and flexibility, ensuring excellent knot security. However, a notable drawback is their springy nature, which can complicate their handling.

Polypropylene sutures: Polypropylene sutures are employed when long-term dermal support is required. They elicit a milder tissue reaction and accommodate tissue swelling effectively. A disadvantage of polypropylene sutures is their stiffness and high memory, which can compromise knot security. Surgeons often need to perform thermocautery (using a heated needle to destroy tissue) to secure the knots.

Polyethylene sutures: Polyethylene sutures are flexible, possess a silky texture, are gentle on gloves and tissues, and are non-abrasive. They are favoured by orthopaedic and cardiovascular surgeons due to the enhanced knot security they provide during the tying process. The low knot profile facilitates accurate placement, ensures a smooth tie-down, and provides exceptional knot break strength.

Polyamide or Nylon sutures: These sutures are the most commonly utilized in surgical procedures. They are made from a substance called caprolactam. Typically, they are employed in soft tissue surgeries, particularly in cardiovascular, ophthalmic, and neurological fields. This material exhibits high tensile strength; however, it diminishes over a period of six months when embedded in tissue. A notable drawback of polyamide sutures is that nylon is rigid, which complicates handling and tying.

3. Foreign bodies after caesarean section

Prolene, a synthetic suture material that is non-absorbable, is extensively utilized in surgical procedures due to its strength and low tissue reactivity. However, in rare cases, it may provoke a foreign body reaction resulting in the formation of a granuloma, referred to as a Prolene granuloma. This granuloma is marked

by chronic granulomatous inflammation and can present as painful masses or persistent discharging sinuses, often emerging months to years after the initial surgical procedure. The pathophysiology of Prolene granuloma involves the immune system's response to the non-absorbable suture material. When the immune system recognizes the Prolene suture as a foreign object, it initiates a chronic inflammatory response, leading to granuloma formation. These granulomas can cause localized inflammation, fibrosis, and the emergence of discharging sinuses.

Abdominal wall sinuses represent a relatively uncommon yet significant complication that may occur following surgical interventions, often manifesting as chronic discharging tracts that can persist long after the initial operation [2].

Causes Retained suture material: The primary cause is the body's reaction to surgical stitches that have not been completely absorbed. This is particularly relevant for non-absorbable sutures like silk or Dacron. Chronic inflammation: The immune system perceives the suture as a foreign entity, initiating a chronic inflammatory response that results in the formation of a granuloma.

Symptoms Painful swelling: A painful lump or soft tissue mass may be present at the caesarean scar. Discharging sinus: There may be a persistent opening in the skin that can leak pus or fluid.

A Prolene granuloma following a caesarean section is an uncommon inflammatory response to the non-absorbable Prolene sutures utilized for closing the abdominal wall. This condition may develop months to years' post-surgery and manifests as a painful lump or a chronic sinus tract that discharges from the scar. Diagnosis is established through imaging and histopathological examination, while treatment necessitates the surgical excision of both the granuloma and the suture material to avert recurrence.

Symptoms and characteristics Delayed onset: This condition can manifest months or even years after the caesarean section. Painful mass: A palpable and tender lump can be felt beneath the scar. Discharging sinus: A passage from the scar that exudes pus, fluid, or other unpleasant-smelling discharge. Skin changes: This may include a ruptured blister or ulceration at the site of the scar.

Diagnosis and treatment Medical evaluation: A physician will assess the symptoms and may employ imaging techniques such as ultrasound to assist in diagnosing the condition.

Treatment: The management typically involves the surgical removal of the granuloma along with the associated suture material.

Post-excision, the surgical site must be carefully reconstructed to facilitate optimal healing. This may require layered closure of the wound, the use of local flaps, or the insertion of drains to prevent fluid build-up and infection. In instances where the granuloma is extensive, more intricate reconstructive methods may be necessary [3]. Timely identification and suitable management are vital for preventing chronic morbidity linked to this condition. Surgical excision of the granuloma and complete removal of the suture material are the cornerstones of treatment.

4. Case study 1

This case report describes an unusual occurrence of multiple chronic discharging abdominal wall sinuses linked to Prolene granuloma in a 35-year-old female patient following a caesarean section. Although abdominal wall sinuses are rare, they can develop as surgical complications, frequently resulting from

foreign body reactions to materials like non-absorbable sutures. Prolene granuloma, an infrequent inflammatory reaction to Prolene sutures, may present as painful masses or discharging sinuses long after the surgical procedure. This case report outlines a rare instance of multiple chronic discharging sinuses linked to Prolene granuloma in a 35-year-old female who had undergone an uncomplicated caesarean section six months prior [4]. Abdominal wall sinuses are rare yet significant complications that may occur after various surgical interventions [5].

5. Case study 2

This case report describes a 34-year-old woman from Korea, who had a caesarean section five months earlier, presented with a small blue object visible through the skin on her left lower abdomen. There were no signs of pain or inflammation noted. Upon examination, the foreign object was identified as a 10-centimeter-long piece of suture material that had migrated laterally about 15 centimeters within the intradermal layer over the past five months, without any tangling along its entire length.

The closure of the skin during a caesarean section is frequently accomplished using subcuticular running sutures made from nonabsorbable suture material. Nevertheless, this type of material carries the risk of not being completely removed after the wound has healed and, in rare instances, may migrate to other areas. nonabsorbable sutures do not create buried knots, which may lead to complications like granulomas or abscesses [6].

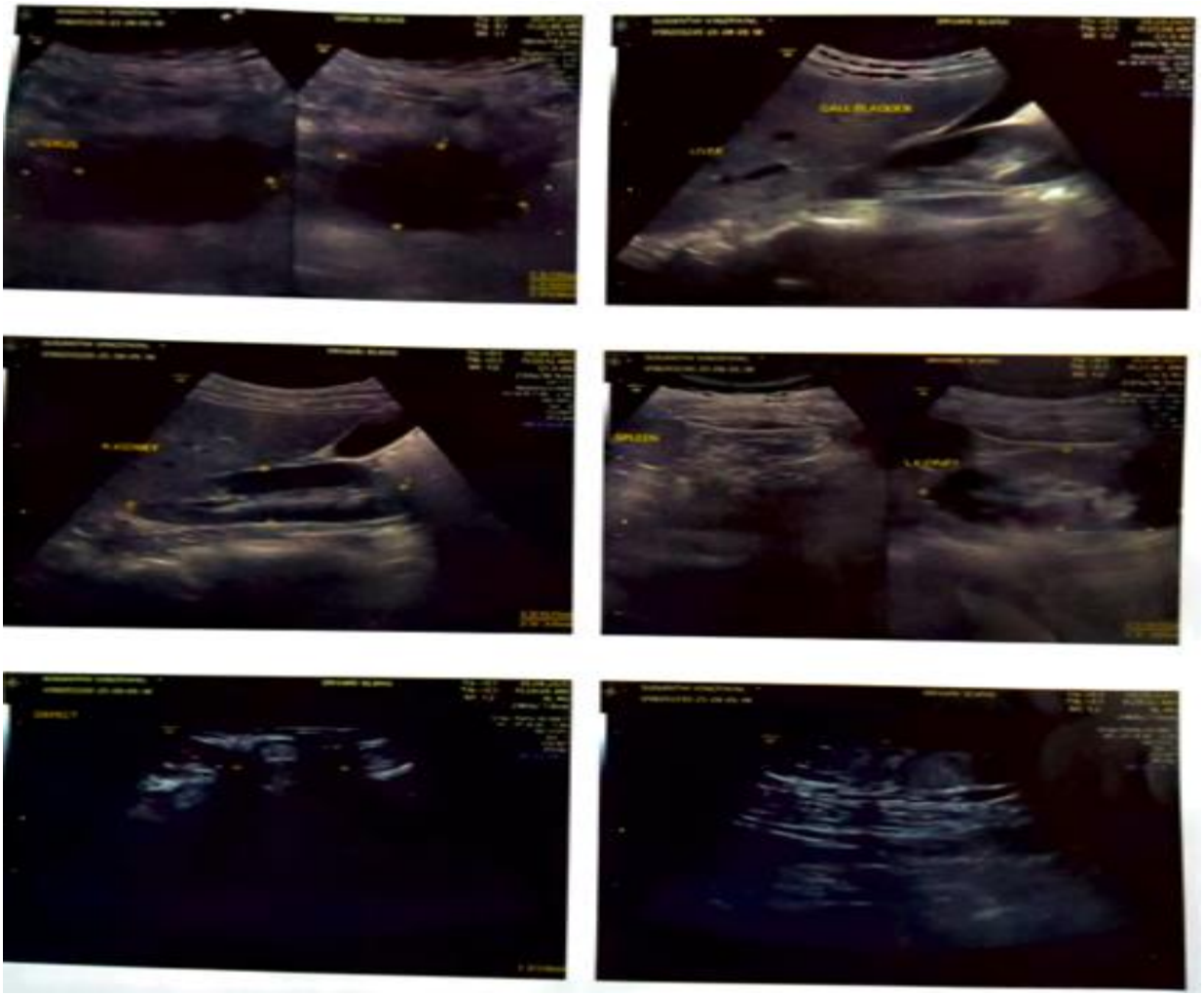
6. Case presentation

Case Presentation a 41-year-old woman, 18 months after a caesarean section, where as per the ultrasound evaluation report 1:

Impression:

Diffuse subcutaneous edema with minimal inter spread collection seen in the post-operative LSCS scar region-Possibly Infective sequelae.

Figure 1: Images of the ultrasound evaluation report 1



The ultrasound evaluation report 2:

C-Section scarring seen involving anterior wall of uterus.

- Thickened echogenic endometrium 16.9mm.
- RT ovary Measures 202*1.8*1.0cms vol-2.2cc;
- LT ovary Measures 2.9*2.6*1.0cms Vol-4.4cc;

Small focal arears of subcutaneous fluid collection with surroundings oedema predominantly involving left side of post-operative suture site- consistent with post-operative changes.

Impression:

Post C-section status

- C-Section scarring involving anterior wall of uterus.
- Thickened echogenic endometrium.
- Focal areas of fluid collection with surroundings oedema involving subcutaneous fat plane, predominately involving left side of post-operative suture site- consistent with post-surgical changes (see Figure 2 & 3).
- Left peri tubal fat stranding.

- These findings suggest a foreign body reaction, likely due to Prolene sutures, raising the suspicion of a Prolene granuloma.

Figure 2: Images of the ultrasound evaluation report 2:

7. Discussion

Diagnosis done after one year three months for

1. Suture site granuloma.

Procedure Done: Excision and primary closure.

Complaints/H/O/presenting Illness: Pain and swelling over the car of lower abdominal left> right to the LSCS wound site. Previous one normal vaginal delivery, I LSCS LCB-I year 3 months years.

Past History: Patient is not known case of hypertension, diabetes mellitus, TB, BA, Cardiac Illness or epilepsy.

Past surgical History: H/o 2024-LSCS ST done.

Findings:

1. Sinus cavity leading to subcutaneous cavity filled with pus.

2.Prolene suture noted.

Operative Notes:

Under SAP, under short GA, Patient in supine position. Parts painted and draped. Incision made at both the ends of the scar. Sinus tract and abscess cavity at the left end of scar excised. Prolene suture extracted into to. Primary closure done. Sterile dressing applied.

A granuloma resulting from a caesarean section is an inflammatory response triggered by retained suture material, such as non-absorbable stitches, which creates a lump or mass at the site of the incision. Commonly referred to as a suture granuloma, this benign condition occurs when the body's immune cells gather around the foreign material, occasionally leading to symptoms such as painful swelling or a persistent discharging sinus. This condition may develop weeks, months, or even years following the surgical procedure.

Understanding the causes, clinical manifestations, and diagnostic techniques is vital for the effective treatment and prevention of additional complications in patients suffering from Prolene granuloma

8. Conclusion

In summary, multiple chronic discharging sinuses in the abdominal wall associated with Prolene granuloma constitute a rare yet significant postoperative complication linked to the use of non-absorbable sutures. This case highlights the necessity of considering Prolene granuloma in the differential diagnosis of ongoing sinuses after surgical interventions. An accurate diagnosis, primarily achieved through imaging and histopathological analysis, is essential for directing suitable surgical management. The effective treatment of such cases generally requires the complete removal of the granuloma and the affected sinus tracts, as well as the extraction of the foreign suture material, to avoid recurrence and ensure the best possible patient outcomes.

9. Authors Biography

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