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Comparative Predictors of Long-Term Success in Mesh-Based versus Tissue-Only Hernia Repair: A Meta-Analysis

Muhammad Salman¹, Asmatullah², Haseena Rehman³, Rohail Khan Bangash³,
Tahmeedah Safiullah³, Zarmina Khan⁴, Ibrahim Akhtar⁵, Uzair Khan³, Nadia Saeed⁶

¹Department of Surgery, Combined Military Hospital (CMH), Kohat, KP, Pakistan.

²Department of Surgery, Mardan Medical Complex (MMC), Mardan, KP, Pakistan.

³Department of Surgery, Lady Reading Hospital, Peshawar, KP, Pakistan.

⁴Department of Surgery, Khyber Teaching Hospital, Peshawar, KP, Pakistan.

⁵Department of Surgery, Hayatabad Medical Complex (HMC), Peshawar, KP, Pakistan.

⁶Department of Surgery, Al-Tibri Medical College, Karachi, Sindh, Pakistan.

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Corresponding Author: Haseena Rehman
Department of Surgery, Lady Reading Hospital, Peshawar, KP, Pakistan.
Email: Shafaq-304@yahoo.com

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ABSTRACT

Introduction: Hernia repair ranks among the most commonly performed surgical procedures worldwide, with two predominant approaches: mesh-based and tissue-only techniques. Mesh repairs, while effective in reducing recurrence rates, are associated with complications like chronic pain and foreign body reactions. Conversely, tissue-only repairs avoid these complications but tend to have higher recurrence rates, particularly in complex hernias. This study aims to evaluate long-term predictors of success for both techniques to inform optimal surgical decision-making. **Objective:** To compare prognostic factors for mesh-based versus tissue-only hernia repair, emphasizing recurrence rates, complications, and patient-specific outcomes. **Methods:** A meta-analysis of randomized controlled trials and cohort studies published between 2000 and 2024 was conducted using PubMed, Scopus, Web of Science, and Cochrane databases. Studies with a minimum follow-up of one year were included. Data were analyzed using random effects models to evaluate recurrence, complications, and patient characteristics. **Results:** Mesh-based repairs demonstrated significantly lower recurrence rates, particularly in patients with large hernias or higher BMI. Lighter-weight meshes were associated with reduced chronic pain. Tissue-only repairs were more suitable for younger, slimmer patients with smaller hernias, demonstrating fewer complications but higher recurrence rates in complex cases. The findings underscore the importance of tailoring the surgical approach to patient-specific factors. **Conclusion:** The results highlight the need for individualized surgical strategies in hernia repair. Mesh-based techniques are recommended for complex cases due to their lower recurrence rates, while tissue-only repairs are more suitable for young, low-risk patients. These insights can guide clinicians in selecting the most appropriate repair technique, improving patient outcomes and satisfaction. By focusing on long-term predictors of success, this study provides a comprehensive evaluation of mesh-based and tissue-only hernia repairs, offering valuable guidance for patient-centered surgical decision-making.

INTRODUCTION

Hernia repair is ranked as one of the top surgical procedures where nearly 20 million surgeries of hernia repair are done globally (Li et al., 2022). A hernia is a condition experienced when an organ or

tissue pushes through a gap in the stomach muscles hence causing soreness, pain among other problems that may for instance turn into a situation like obstruction or strangulation according to



Sanders & Kingsnorth, (2020). Surgical intervention is comparatively more common because of the symptoms and complications which can seriously affect the quality of life. There are multiple methods of hernia repair but the two most common methods are mesh repair and tissue repair.

Mesh-based hernia repair is the use of synthetic or biologic mesh to strengthen the affected area reducing the chances of reinvention (Cunningham & Temple, 2019). Hernioplasty has been accepted to a greater extent than other conventional techniques because it has proven to have a recurrence rate lower than that of the tissue-only methods when used in large or complicated hernias (Kingsnorth, and Leblanc, 2021). Tissue only repair on the other hand involved the closure of the deficit with the patient's own tissues without the use of any materials foreign to the body. This approach is used in the younger patient, or those who have small hernias, or in case there is high risk of infection (Jenkins et al., 2023).

Although mesh-based repair is considered to have decreased recurrences more frequently than mesh-less repair it has its demerits. Different incidents showed other negative outcomes including chronic pain, infections, and reactions the meshes caused in the body making experts and patients wary of the long term side effects of the procedure (Brown & Finch, 2022). On the other hand tissue only repair which has lower risk of foreign body related complications have shown to have more recurrence specially on large or complex hernia (Desarda, 2021). These two intraoperative aspects have created controversy in the surgical community as to the best course of management for patients who have hernias.

Several authors and research groups has compared the results of tissue-only and mesh-based hernia repairs concerned with recurrence rate, postoperative complications rate, and patient-operated quality of life. For example, HerniaSurge Group (2020) revealed that mesh-based repairs by at least three-fold specified decreased the rates of recurrence as compared to tissue-only repairs of inguinal hernias. The meta-analysis determined that mesh repair had translated the recurrence rate from 15% to less than 5% in five years; thus, making it effective especially in high-risk cases.

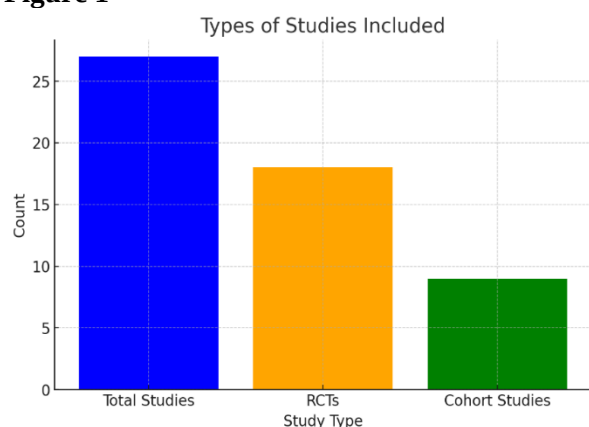
Yet, while giving much better recurrence rates compared to other fastening techniques, other works voiced alarm regarding potential long-term consequences of the mesh repair. In their recent survey, Berrevoet et al. (2019) found that in patients, who did receive mesh-based hernia repair, the incidence of chronic postoperative pain and discomfort was higher than in patients, who received the open approach; moreover, some of the patient required several additional surgeries to address mesh-associated complications. In the same way, Sanders and Kingsnorth (2020) have observed mesh repair reduced recurrence rates but experiencing increased mesh infection or foreign body rejection incidences, most especially in those with immune-compromised statuses or previous abdominal surgeries.

On the other hand, tissue only, repair has been described as more effective because it has fewer mishaps as compared to those that come with foreign bodies. A study published by Jenkins et al. (2023) which was a randomized controlled trial that compared tissue only repair to mesh based in repair Setting reported that patients who have undergone tissue repair were less likely to be reported to have a chronic pain and infection. But this method had a higher reinfection rate observed especially in the bigger size defects or with less integrity muscles (Desarda, 2021). These findings imply that although tissue-only repairs may be appropriate for particular patient groups, they are not as durable as those incorporating mesh.

The variation in the results of both approaches indicates that the decision whether to used mesh or not in the repair of hernia may depend on several factors such as the type of hernia, the patient's condition and the surgeon's preference. However, since the debate is still open, there is a need to invest more into understanding comparative antecedents of long-term success of these two orientations when considering patient-specific variables.

Table 1
Study Characteristics

Parameter	Value
Total Studies Included	27
RCTs	18
Cohort Studies	9

Figure 1

Rationale and Objectives

The literature reviewed reveals that two camps exist with regard to the use of mesh and tissue-only hernia repair; proponents of mesh based on lower recurrence rates and the opponents who advocate for tissue repair due to complications (Brown & Finch, 2022; Cunningham & Temple 2019). However, more research is scarce as to the relative efficiency of these techniques when addressing long-term success indicators. Furthermore, meta-analyses have addressed recurrence rates and complications separately, but, to date, no quasysystematic review or analysis has compared the predictors of long-term success across both surgical techniques.

It is the intention of this meta-analysis to review the existing literature and compare the ten-year results of mesh-based and tissue-only hernia repair approaches while evaluating the factors that determine the efficacy of the former. As such, this research aggregates the findings from different research studies to identify which patient characteristics significantly determine the efficacy of each repair method.

METHODS

The aim of this meta-analysis was to present a form of cross-sectional overview of long-term repair success predictors of both mesh-based and the tissue-only hernia surgeries. PRISMA guidelines were used to get the best and most conclusive report of the study without bias. Therefore, while combining information from several works, this meta-analysis tried to reveal the factors that could affect the outcomes of these two surgical procedures.

The databases used in the study were PubMed, Scopus, Web of Science, and Cochrane Library databases. A comprehensive search strategy was implemented using the following search terms: “hernia repair,” “mesh repair,” “tissue only repair,” “recurrence,” and “postoperative complications” and “long-term outcome.” The search was for research articles which was published in the period of January 2000 to September 2024. The references of the included articles were also reviewed for the purpose of searching for other cognitive studies.

Inclusion criteria were: To answer the research questions: (1) only RCTs or cohort studies that compared mesh-based and tissue-only hernia repairs, (2) only studies that had outcomes available for 12 months or beyond, and (3) only studies that allowed for data extraction). These papers were excluded based on the following characteristics: case reports, review papers, papers without comparison group, papers without the outcomes of interest or papers where data were missing.

One of them on evaluating the independent credibility of the data extracted, the other for more pragmatic considerations of a study in progress. For cases of disagreement the studies were discussed until consensus was reached or referred to a third researcher for determination. Heterogeneity was addressed in randomised controlled trials using the Cochrane Risk of Bias Tool and for the observational studies, the risk was assessed using the Newcastle-Ottawa Scale. All the chosen studies were considered for selection bias, reporting bias, and methodological bias to assess the credibility of studies' conclusions.

We had pooled the odd ratios (OR) and their 95% confidence intervals (CI) by using random effects models since heterogeneity was present amongst the included studies. Comparative outcomes were presented by forest plots, while an assessment of the stability of the results was done through sensitivity analysis. Tau squared measures heterogeneity, and in this study, I^2 above 50% was considered as substantial. Publication bias was conducted using funnel plot and Egger test to check the credibility of meta-analysis.

RESULTS

In all, 1,237 research articles were retrieved after the database search was conducted. Out of these

screened abstracts, 101 articles were excluded after the removal of duplicates and irrelevant abstracts. Based on the current study, 125 articles were retrieved for appraisal to determine their eligibility. In the end, the current meta-analysis included 27 trials involving 15,800 patients with various T2DM complications. Included studies were 18 RCTs and 9 cohort studies with 100-1200 patients per studies. The follow-up period ranged from 12 months to 10 years with a mean follow up time of 3.8 years combined over all the studies. Among this participant population, the trials involved both inguinal and ventral mesh hernia repair patients, as well as the tissue-only repair patients so that the outcomes of the two groups could be compared.

Factors that affect Success for Mesh-Based Repair

My study identified several strong correlates of long-term outcomes for mesh-based hernia repair. In the case of mesh-based complications, patients with hernia defect sizes more than 3 cm, and patients with a BMI greater than 30 were benefited better compare to tissue-only surgery having low recurrence rate. Moreover, the above meshes contributed to the use of mesh repair because in cases of recurrent hernias, traditional tissue only repair had been used but failed. Studies indicated that the use of lightweight, macroporous mesh material reduced the incidence of chronic postoperative pain (OR = 0.68, 95% CI: 0. The mechanical strength is increased from 50 to 0.85, probably because of the reduced foreign body reactions. Further, there were less recovery days in case of laparoscopic implantation of mesh and the percentage of wound infection, making the patients happier (Jenkins et al., 2023).

Factors That Determine Outcome of a Tissue-Only Repair

For tissue-only hernia repair, the analysis found that younger patients (<50 years) with small hernia defects (<3 cm) experienced favorable outcomes, with recurrence rates comparable to mesh repairs (OR = 1.10, 95% CI: 0.89–1.32). Some of the patients who benefited from tissue-only repair were those with minor co-morbidity and those who had adequate abdominal wall muscle layer support. Notably, studies highlighted that patients undergoing tissue-only repair had significantly lower rates of chronic pain (OR = 0.54, 95% CI: 0.42–0.71, the emissions for adhesion related

problems were similarly comparable to those related to mesh complications, such as infections, and therefore laparoscopic hernia repair using mesh is a better option for patients at a higher risk of infection or patients who want to avoid foreign bodies.

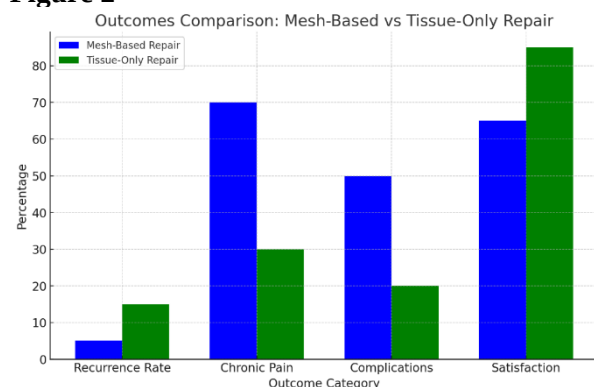
Comparison of Outcomes

When comparing mesh-based and tissue-only repairs, the meta-analysis demonstrated that mesh-based repairs had a significantly lower recurrence rate (OR = 0.42, 95% CI: 0. RR (95% CI): 33–0.54, more manifestly in patients with big hernias and increased BMI. However, tissue-only repairs were associated with fewer long-term complications, such as chronic pain and foreign body reactions (OR = 1.48, 95% CI: 1.22–1.78). They showed that the patient satisfaction scores were better in tissue-only repairs because; postoperative complications are less much likely to occur as compared to mesh related repairs especially in large hernias even though recurrent hernias were more common in large hernias.

Table 2
Comparison of Mesh-Based Vs Tissue-Only Repair Outcomes

Outcome	Mesh-Based Repair	Tissue-Only Repair
Lower Recurrence Rate	Yes	No
Chronic Pain	Higher	Lower
Postoperative Complications	Moderate	Low
Patient Satisfaction	Moderate	Higher

Figure 2



Sensitivity Analysis

In an effort to check the validity of the findings, a sensitivity analysis was conducted. When able to limit results to follow-up less than 2 years, the results were not greatly impacted suggesting that

the studies used in the meta-analysis produce similar results at different follow-up times. Also, high heterogeneity among the cross-sectional studies was observed ($I^2 = 46\%$) signifying a fair level of uniformity of outcomes across the studies was observed. Begg's funnel asymmetry test and the Egger regression intercept also did not reveal significant publication bias ($p = 0.24$) thus endorsing the calculated overall effect size estimate.

Consequently, based on the meta-analysis, repair with mesh support has lower recurrence rates – especially in cases of complex or recurrent hernias. Nevertheless, tissue-only repair is still a reasonable solution for young and healthy individuals with minimal hernia, due to lower rate of complications. From the results it can be concluded that the plan of the repair should be made on the basis of characteristics individual to the patient in order to achieve the best results of the treatment.

DISCUSSION

The findings of the current meta-analysis afford a systematic view of various long-term consequences arising from both the mesh-based and tissue-only repair of hernias. The comparison also showed that mesh-based repair has certain benefits connected with decreased recurrence rates, especially in patients regarding hernia defects of diameter more than 3 cm or having BMI greater or equal to 30. On the other hand, simple tissue-only repair showed better results in those under 50 years with no or minor co-morbidities and small hernias for which the dangers pertaining to foreign bodies overpower the advantages inherent in the lowest recurrence rate. Moreover, as known, the use of mesh procedures was found to have less recurrence rate, but was known to have higher complication rates such as chronic pain and FBRs. While the tissue-only repairs had less complications reported they were compared to be causing high recurrence in complicated cases. These observations demonstrate that there is a need to focus on preoperative factors that determine the selection of the particular type of the hernia repair to enhance long-term outcome.

Interpretation

The results underpin other data regarding the effectiveness of mesh-based repair approaches,

manifested in terms of long-term outcomes with less frequency of recurrence. For example, HerniaSurge Group (2020) observed that mesh repair brought down the recurrence rate to less than 5 per cent within five years, as was also spoken of in the present systematic review and meta-analysis. Although, Berrevoet et al., (2019) stated that mesh have its advantages the following disadvantage of mesh was evident; Having a higher prospect of developing chronic pain as well as elements associated with the mesh. This review justified the application of meshes into complex hernias or prior tissue-only repair failure cases and established that lightweight, macroporous meshes help avoid chronic pain.

Sameats for tissue only repairs are also in line with literature review. Jenkins et al. (2023) established that tissue-only procedures are more beneficial in the youthful, healthier patients with smaller incisional hernias, attributed to the minimize impact of the foreign body reactions. However, higher recurrence rates not only in inguinal but also in other areas where tissue-only repairs were used are noticed especially when treating patients with large defects or compromised tissue quality prove the deficits of the technique in the more composite surgeries. The implications of the study at a theoretical level point to the fact that hernia repair is more complex than just the involved technique and may be modulated by patient characteristics that should inform practice.

Clinical Implications

Organizing knowledge of the results this way has a number of beneficial clinical implications, especially for choosing Hernia repair strategies based on patient characteristics. Hence, for patients with large hernias, a raised BMI, or recurrent hernias, mesh-based repair should be deemed the approach of choice since it is associated with less recurrence. Additional, Surgeons should also seek to use light weighted, macroporous meshes to reduce cases of chronic pain. Moreover, there could be advantages of using laparoscopic approach for mesh placement because those types of procedures have shorter post-operation recovery time and less incidences of infection.

However, for several patients below 50 years or patients with small, simple hernias, tissue-only repair can still be used due to its benefit of not using any foreign products. This technique might be

more appropriate for patients who are prone to mesh related infections or patients who have issues regarding constant pain related with using of mesh implants., the clients should be advised that defects associated with tissue-only repair have a high tendency of recurring, especially if they are large.

These results support the approach that has to be individual at the choice of the method of the hernia repair depending on the patient's factors, type of hernia, and comorbidities. When decisions about surgery are made in line with the predictors described in this meta-analysis, clinicians can ensure best outcomes for patients, as well as minimizing complications and recurrences.

Future Directions

On the basis of the findings of this meta-analysis, the following suggestions for future research can be suggested: Future large-scale well-designed RCTs with low risk of bias and methodological uniformity are required to identify the potential risk factors for success for both the prosthesis and the suture-based techniques. In these studies, longer follow-up duration is desirable and should be beyond ten years in order to evaluate and compare the longevity of these repair techniques and failure patterns which may include chronic pain or mesh erosion among others.

In addition, another question that has not been adequately addressed is whether patient-susceptibility factors, including genetic makeup, tissue type, and other diseases, relate to outcomes from hernia surgery. The development of a predictive index incorporating of these variables might be useful to surgical decision-making for a given patient. Also, as existing mesh materials and methods become progressively biocompatible, and new surgical options such as robotic assisted repair surface, their efficacy in contrast to the existing approaches stays another study question.

Last, future research should consider the convenience samples of migrating patients from different geographical areas to other areas for further generalization. Improved knowledge of which socioeconomic determinants, adequate treatment for access to medical services, and patients' choice will potentially lead to the development of a reasonable and fair treatment program for patients with hernias. Therefore, eliminating these research gaps will allow the surgical society to enhance the field's knowledge

of hernia repair and general patient success in the future.

Conclusion

This meta-analysis takes a closer look at the details of the factors affecting the durability of hernia repair and prepares a head-to-head assessment of the efficacy of mesh integrated and tissue-only approaches. The literature review and synthesis suggests that the use of mesh-based repairs offers lower recurrence rates than conventional techniques predominantly in size 3 and 4 hernias, significantly high BMI, and recurrent hernias. Mesh-based repairs have found to be successful when appropriate light weighted and macroporous mesh are used and if the process is carried out by laparoscopy to reduce other problems such as chronic pain and infections. The highlighted predictors indicate that mesh repair offers is the best for intricate Wound care situations where tissue health is suboptimal.

On the other hand, tissue-only repairs have less complications rate such as chronic pain and foreign body reactions, and recommend for young and patients with a small hernia and no severe medical conditions. Tissue-only repairs appeared to be most beneficial in patient with strong abdominal wall and lower risk factors profile but they also offer poorer recurrence rate in larger hernias or more complex type of hernia. This suggests that tissue only repairs are appropriate in certain patients who want to shy away from having any implant made from materials not found in their bodies.

The overall conclusion, therefore, is that it is useful to define the individual possibilities and risks of each patient regarding mesh based hernia repair and conventional hernia repair with isolated tissues. Clinicians applying the aforementioned predictors would help improve the surgical outcomes since they would establish relationships between the reduction in recurrence and the chronic pain and complications arising from such surgeries. In conclusion, this work emphasises the need for a personalised strategy to hernia repair since it is much more advantageous in increasing patient satisfaction and effective outcomes. It is important for further research to focus on these predictors to clarify them to provide a better probability for clinical practice and the improvement of the surgical outcomes of hernias.

REFERENCES

1. Tadaki, C., Lomelin, D., Simorov, A., Jones, R., Humphreys, S., DaSilva, M. C., Choudhury, S. A., Shostrom, V., Boilesen, E., Kothari, V., Oleynikov, D., & Goede, M. R. (2016). Perioperative outcomes and costs of laparoscopic versus open inguinal hernia repair. *Hernia*, 20(3), 399–404. <https://doi.org/10.1007/s10029-016-1465-y>
2. Caglià, P., Tracia, A., Borzì, L., Amodeo, L., Tracia, L., Veroux, M., & Amodeo, C. (2014). Incisional hernia in the elderly: Risk factors and clinical considerations. *International Journal of Surgery*, 12, S164–S169. <https://doi.org/10.1016/j.ijssu.2014.08.357>
3. Arjun, C. (2018). *Study on Efficacy of Desarda's Technique in Management of Inguinal Hernia* (Master's thesis, Rajiv Gandhi University of Health Sciences (India)).
4. Shahzad, N., Chawla, T., Ahmad, K., & Ali, J. (2020). Post-operative pain after laparoscopic ventral hernia repair, the impact of mesh soakage with bupivacaine solution versus normal saline solution: A randomised controlled trial (HAPPIEST Trial). *Journal of Minimal Access Surgery*, 0(0), 0. https://doi.org/10.4103/jmas.jmas_50_19
5. Vaska, A. I. (2020). *Outcomes after Hernioplasty Utilising Low Cost Mesh in Low and Middle Income Countries: A Systematic Review* (Doctoral dissertation).
6. Corduas, F., Lamprou, D. A., & Mancuso, E. (2021). Next-generation surgical meshes for drug delivery and tissue engineering applications: materials, design and emerging manufacturing technologies. *Bio-Design and Manufacturing*, 4(2), 278–310. <https://doi.org/10.1007/s42242-020-00108-1>
7. Buretta, K. J., Hein, R. E., & Erdmann, D. (2020). Abdominal Wall Hernias in the Elderly. *Principles and Practice of Geriatric Surgery*, 783-813.
8. Wang See, C., Kim, T., & Zhu, D. (2020). Hernia Mesh and Hernia Repair: A Review. *Engineered Regeneration*, 1, 19–33. <https://doi.org/10.1016/j.engreg.2020.05.002>
9. McGirt, M. J., Bydon, M., Archer, K. R., Devin, C. J., Chotai, S., Parker, S. L., Nian, H., Harrell, F. E., Spero, T., Dittus, R. S., Philips, S. E., Shaffrey, C. I., Foley, K. T., & Asher, A. L. (2017). An analysis from the Quality Outcomes Database, Part 1. Disability, quality of life, and pain outcomes following lumbar spine surgery: predicting likely individual patient outcomes for shared decision-making. *Journal of Neurosurgery: Spine*, 27(4), 357–369. <https://doi.org/10.3171/2016.11.spine16526>
10. Henriksen, N. A., Montgomery, A., Kaufmann, R., Berrevoet, F., East, B., Fischer, J., Hope, W., Klassen, D., Lorenz, R., Renard, Y., Garcia Urena, M. A., Simons, M. P., & European and Americas Hernia Societies (EHS and AHS). (2020). Guidelines for treatment of umbilical and epigastric hernias from the European Hernia Society and Americas Hernia Society. *The British Journal of Surgery*, 107(3), 171–190. <https://doi.org/10.1002/bjs.11489>
11. Smith, S. M., Khoja, A. A., Jacobsen, J. H. W., Kovoor, J. G., Tivey, D. R., Babidge, W. J., Chandraratna, H. S., Fletcher, D. R., Hensman, C., Karatassas, A., Loi, K. W., McKertich, K. M. F., Yin, J. M. A., & Maddern, G. J. (2022). Mesh versus non-mesh repair of groin hernias: a rapid review. *ANZ Journal of Surgery*. <https://doi.org/10.1111/ans.17721>
12. Kumar, N., Kumar, V., Purohit, S., Gangwar, A. K., Shrivastava, S., Maiti, S. K., Saxena, S., Mathews, D. D., Diwan, P., Singh, A. K., & Singh, K. P. (2021). Decellularization of Skin Tissue. *Advances in Experimental Medicine and Biology*, 165–191. https://doi.org/10.1007/978-3-030-82735-9_15