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Evaluation of Vaginoplasty Outcomes Using Skin Grafts versus Amniotic Membrane: A Comparative Cross Sectional Study

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ABSTRACT

Introduction: Vaginoplasty is a reconstructive surgical procedure for vaginal agenesis or other indications. Traditional techniques involve the use of skin grafts, while the amniotic membrane has emerged as a promising alternative due to its better compliance and healing properties.

Objectives: The objective was to compare the outcomes of vaginoplasty performed using skin grafts versus amniotic membranes.

Methodology: A comparative cross-sectional study was conducted at a tertiary care center from June 30, 2023 to June 30, 2025, involving 15 female patients who underwent vaginoplasty. Of these, 5 received autologous skin grafts and 10 received preserved human amniotic membranes. Patients with no prior vaginoplasty and without contraindications for elective surgery were included. Ethical approval was obtained, and informed consent was secured. Clinical outcomes such as operative time, blood loss, postoperative pain, mold duration, epithelialization, UTI, vaginal stenosis, final vaginal length, complications, and compliance were assessed. Data were collected via a structured proforma, followed up telephonically, and analyzed descriptively using Microsoft Excel 2016.

Results: A total of 15 patients aged 16–24 years were included, with 5 undergoing vaginoplasty using skin grafts and 10 using amniotic membrane graft. Operative time and blood loss were higher in the skin graft group (60–120 min; 40–80 mL) compared to the amniotic membrane group (35–60 min; 20–40 mL). Postoperative pain scores on Day 1 were also higher in the skin graft group (7.2 ± 1.1 vs. 4.5 ± 0.9). Epithelialization was good in both groups. One UTI occurred in each group. At 3-month follow-up, vaginal stenosis was observed in one skin graft and three amniotic membrane cases. The mean final vaginal length was 9 cm in the skin graft group and 8 cm in the amniotic group. No major complications were reported. Patient compliance was better in the amniotic membrane group, likely due to reduced pain and faster recovery.

Conclusion: Vaginoplasty with amniotic membrane showed faster recovery and better patient comfort, while skin grafts provided slightly superior anatomical outcomes. Both techniques were safe with minimal complications.

Introduction

Vaginoplasty is a critical reconstructive procedure for patients with congenital or acquired vaginal absence. Conditions such as Mayer-Rokitansky-Küster-Hauser (MRKH) syndrome, which affects approximately 1 in 4,000–5,000 female births, are among the most common congenital indications.[1,2] Acquired causes include trauma, oncologic resection, and severe infection. The primary goal

of vaginoplasty is to construct a functional neovagina with adequate length, caliber, lubrication, and sexual function while minimizing complications such as stenosis or graft failure.[3] Historically, the McIndoe vaginoplasty using split-thickness skin grafts (STSGs) has been widely performed. It offers good anatomical results but is associated with notable drawbacks, including donor site morbidity, prolonged operative time, postoperative pain, and occasional graft contracture or stenosis.[4,5] With the advancement of regenerative medicine, alternative graft materials are being investigated to improve surgical outcomes and reduce complications. Among these, the human amniotic membrane has gained particular attention.[6] It is derived from placental tissue and possesses unique biological properties, including anti-inflammatory, anti-fibrotic, antimicrobial, and pro-epithelialization effects.[7] Its use has been documented in ophthalmic surgery, chronic wound healing, burn treatment, and more recently, urogenital reconstruction.[8] Its pliability, biocompatibility, and ability to support tissue regeneration make it an attractive alternative to traditional graft materials.[9] Preliminary case series and small-scale studies have shown promising results in using the amniotic membrane in vaginoplasty, but there is a lack of robust comparative data evaluating its efficacy and safety relative to skin grafts.[10]

Hence, this study was conducted to compare the outcomes of vaginoplasty performed using skin grafts versus amniotic membranes focusing on operative parameters, postoperative recovery, anatomical outcomes, and complications.

Methodology

This comparative cross-sectional study was conducted at a tertiary care center over a two-year period, from June 30, 2023, to June 30, 2025. A total of 15 female patients diagnosed with Mayer-Rokitansky-Kustner-Hauser syndrome and had undergone vaginoplasty between January 2019 and June 2023 were included in the study. Among them, 5 patients received vaginoplasty using autologous skin grafts, while 10 underwent the procedure using preserved human amniotic membrane. Female patients with no prior history of vaginoplasty were included in the study, whereas those with comorbidities that contraindicated elective surgery were excluded.

Ethical approval was obtained from the Institutional Review Committee (approval number IRC-PA-306/2023). All ethical principles were strictly followed throughout the research process. Informed consent was taken from all participants after explaining the study's objectives and procedures, and participants were assured of confidentiality. Participation was voluntary, and patients had the right to withdraw at any stage without any impact on their medical care.

In the skin graft group, a neovaginal canal was surgically created and lined with a split-thickness skin graft harvested from the patient's thigh. A vaginal mold was inserted to support graft adherence and maintain the neovaginal space during healing. Similarly, in the amniotic membrane group, the neovagina was constructed and lined with preserved human amniotic membrane, which was thoroughly rinsed in normal saline before placement. The membrane was then secured using a vaginal mold to ensure proper healing and space maintenance.

Data were collected on several clinical parameters to compare the outcomes between the two surgical techniques. These parameters included operative time (in minutes), intraoperative blood loss (in milliliters), postoperative pain score on the first postoperative day (measured using the Visual Analog Scale), and the duration of mold placement (in days). Additional outcomes assessed included the quality of epithelialization, incidence of urinary tract infection, occurrence of vaginal stenosis at three months, final vaginal length (in centimeters), postoperative complications, and overall patient compliance.

Data collection was done using a structured proforma developed in Google Forms. Follow-up interviews were conducted via telephone at least two years after the last vaginoplasty procedure. The collected data were managed and cleaned using Microsoft Excel version 2016. Descriptive statistical analysis, including calculation of frequencies, percentages, means, and standard deviations, was performed to summarize and interpret the findings.

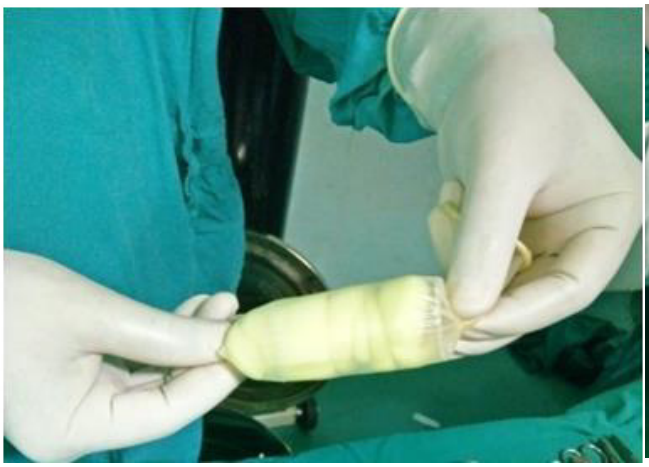

Figure 1. a: Mould lined by amnion graft

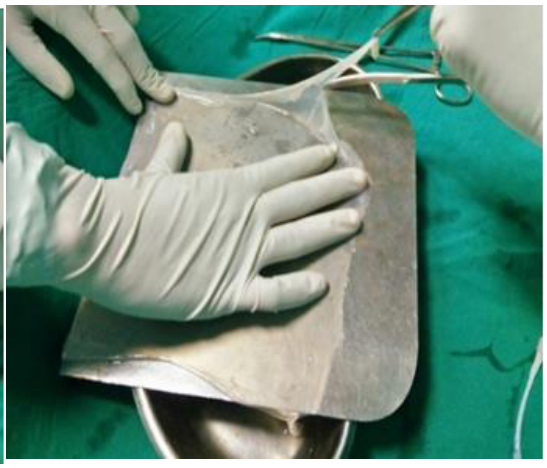

Figure 1. b: Graft preparation11

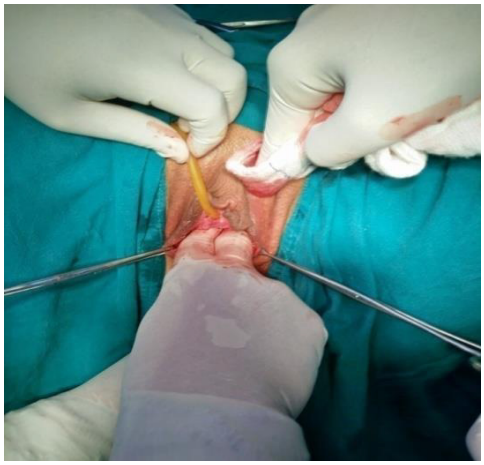

Figure 2: Neo-Vagina Creation11

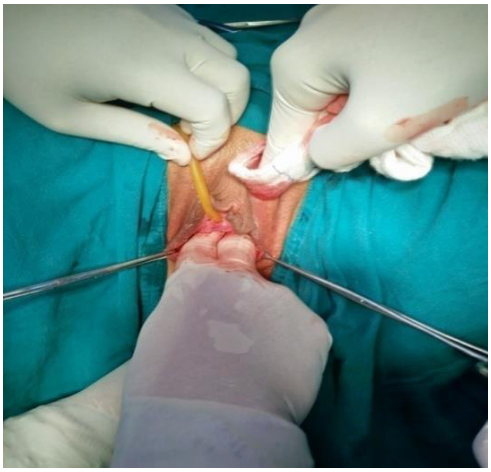

Figure 3: Amnion graft for lining the neo-vagina McIndoe's method11

Results

A total of 15 patients were included in the study, with 5 undergoing vaginoplasty using skin grafts and 10 using amniotic membrane. The age range of patients in both groups was 16 to 24 years. The operative time was longer in the skin graft group, ranging from 60 to 120 minutes, compared to 35 to 60 minutes in the amniotic membrane group. Intraoperative blood loss was also higher in the skin graft group (40–80 mL) than in the amniotic group (20–40 mL). The duration of mold placement ranged from 7 to 10 days in the skin graft group and 7 to 8 days in the amniotic membrane group.

Postoperative pain, assessed using the Visual Analog Scale (VAS) on the first postoperative day, was significantly higher in the skin graft group (mean 7.2 ± 1.1) compared to the amniotic membrane group (mean 4.5 ± 0.9). Epithelialization was noted to be good in both groups. One case of urinary tract infection (UTI) was observed in each group, with no significant difference in incidence. No cases of impaired regeneration or other early complications were noted in either group.

At three months of follow-up, vaginal stenosis was observed in one patient in the skin graft group, with a final vaginal length of 10 cm. In contrast, three patients in the amniotic membrane group developed stenosis, with final vaginal lengths ranging from 5 to 9 cm. Despite this, the average final vaginal length was 9 cm in the skin graft group and 8 cm in the amniotic membrane group. No intraoperative or postoperative complications were recorded in either group. Patient compliance was reported to be better in the amniotic membrane group compared to the skin graft group, likely due to reduced postoperative pain and faster recovery (table 1).

Table 1: Comparison of Clinical Outcomes Between Skin Graft and Amniotic Membrane Groups of Vaginoplasty (n=15)

Parameter	Skin graft (n=5)	Amniotic membrane (n=10)
Age Range	16-24 years	16-24 years
Operating Time	60–120 minutes	35–60 minutes
Blood Loss	40–80 mL	20–40 mL
Mold Removal (days)	7-10	7-8
Postoperative Pain Score (VAS, Day 1 Mean ± SD)	7.2 ± 1.1	4.5 ± 0.9
Epithelialization	Good	Good
UTI Incidence	1	1
Regeneration Issues	Nil	Nil
Stenosis (at 3 months)	1 case (10 cm)	3 cases (5-9 cm)
Final Vaginal Length	9cm	8cm
Complications	Nil	Nil
Patient Compliance	Moderate	Better than skin graft

Discussion

This study aimed to compare the clinical outcomes of vaginoplasty using traditional autologous skin grafts and preserved human amniotic membrane in young females with vaginal agenesis. Although the sample size was modest, the comparative design allowed for insightful observations on operative parameters, anatomical outcomes, complication rates, and patient-reported discomfort. One of the most notable advantages observed in the amniotic membrane group was the reduction in operative time (35–60 minutes) compared to the skin graft group (60–120 minutes). This time efficiency may be attributed to the absence of donor site harvesting, which is required in skin graft procedures. Shorter surgeries generally carry fewer anesthesia-related risks and lead to faster recovery. Likewise, blood loss was lower in the amniotic group (20–40 mL vs 40–80 mL), suggesting less intraoperative trauma, potentially translating into fewer postoperative complications and reduced hospitalization time. These findings are consistent with the literature advocating for minimally invasive grafting alternatives in pelvic reconstructive surgeries.[12,13]

Pain scores were significantly lower in patients receiving amniotic membrane grafts (VAS mean 4.5 ± 0.9) than in the skin graft group (VAS mean 7.2 ± 1.1). The reduction in pain can be largely explained by the lack of a secondary surgical wound (i.e. donor site), which is a known source of substantial discomfort in skin graft procedures.[14] This also likely contributed to the improved patient compliance observed in the amniotic group, facilitating better postoperative care adherence such as mold usage and hygiene protocols. The pain-relieving and anti-inflammatory properties of the amniotic membrane further support this advantage.[15] Both groups achieved good epithelialization, affirming the biological compatibility of both grafting methods in forming a neovaginal lining. However, the amniotic membrane's known pro-epithelialization and anti-fibrotic effects could provide longer-term benefits in mucosal regeneration, although these were not fully captured in the study's three-month follow-up.[16] The final vaginal length was slightly higher in the skin graft group (9 cm) compared to the amniotic group (8 cm), but both fell within the range considered functionally adequate for sexual activity and patient satisfaction.[17] However, longer follow-up would be necessary to determine the durability of these outcomes.

In our study, stenosis occurred in one patient in the skin graft group and in three patients in the amniotic group. While the final vaginal length in stenotic cases of the amniotic group ranged from 5 to 9 cm, these outcomes raise questions about long-term structural integrity when using amniotic tissue. However, it's important to contextualize this within the inherent variability of healing responses and mold adherence practices among patients. Other reports have indicated variable rates of stenosis depending on the fixation method and postoperative compliance, even up to 11%.[18] Notably, no intraoperative or early postoperative complications occurred in either group, underscoring the procedural safety of both techniques when performed under skilled hands. Patient compliance, an important and often underreported outcome, was higher in the amniotic group. This was likely due to reduced postoperative pain, faster recovery, and absence of additional surgical wounds. Such factors are increasingly important in younger populations who value minimal morbidity and quick return to normal activities. Studies in reconstructive surgery have emphasized the significance of patient-centered outcomes, especially when cosmetic and functional factors intersect.[19] Despite the promising results, the influence of hormonal milieu, especially in adolescents and young women with Müllerian agenesis, could play a significant role in neovaginal maintenance.[20] Additionally, histological analysis of the neovaginal tissue over time could provide mechanistic insights into the regenerative dynamics of amniotic membrane versus autologous grafts.[21] As patient satisfaction and sexual function are essential long-term goals of vaginal reconstruction, future studies should incorporate validated quality-of-life instruments and sexual function indices to comprehensively evaluate outcomes.[22]

Conclusion

Both skin grafts and amniotic membranes are safe and effective materials for vaginoplasty, with minimal complications observed. The use of amniotic membrane was associated with shorter operative time, reduced blood loss, lower postoperative pain and better patient compliance, likely due to its favorable healing properties and less invasive nature. While skin grafts offered marginally better anatomical outcomes, such as slightly longer final vaginal length, the amniotic membrane technique provided improved patient comfort and faster recovery. These findings support the amniotic membrane as a promising alternative for vaginoplasty, especially in settings prioritizing patient recovery and satisfaction.

Recommendations

We recommend further multicentric, randomized controlled trials with larger cohorts and standardized postoperative protocols. Moreover, histological studies evaluating the quality of neovaginal mucosa formed by amniotic membrane compared to skin grafts could offer deeper insights. Cost-effectiveness analyses would also be beneficial to healthcare systems evaluating the implementation of amniotic-based reconstructions.

Limitations of the Study

This study is limited by a small, unequal sample size, short follow-up, and lack of randomization. Outcomes like pain and compliance were subjectively assessed, and long-term, functional, or histological evaluations were not included. Findings may not be generalizable due to the inclusion of single-center settings.

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Conflict of Interest

The authors declare that there is no conflict of interest related to this study. There were no competing interests or any personal, financial, or professional relationships that could have influenced the study's design, data collection, analysis, or reporting of findings. The study was conducted with the highest ethical standards and transparency.

Financial Disclosure

The authors confirm that there were no financial disclosures related to this study. This research was entirely self-funded, and no external funding or sponsorship was received for the study's design, execution, or publication. All expenses related to the study were borne by the researchers themselves, ensuring complete independence and impartiality in the study's conduct.

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