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COMPARISON OF ACHILLES TENOTOMY DONE UNDER GENERAL ANESTHESIA VERSUS LOCAL ANESTHESIA IN CLUB FOOT PATIENTS TREATED BY PONSETI METHOD

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Abstract

Background: *Clubfoot is a common congenital deformity that is often treated using the Ponseti method, which includes Achilles tenotomy. The choice of anesthesia general or local during the procedure may influence the duration of the surgery, recovery time, and overall patient outcomes.* ***Objective:*** *To evaluate and compare the clinical outcomes of Achilles tenotomy in clubfoot patients treated by the Ponseti method, performed under general anesthesia versus local anesthesia.* ***Methods:*** *This Randomized Controlled Trial was conducted at Department of Orthopedics, Ayub Teaching Hospital Abbottabad from September 2023 to February 2024. Data were collected through Non-probability consecutive sampling. Baseline demographic data, including age, gender, and weight, were collected for each patient. Informed consent was obtained from the parents, explaining the potential risks and benefits of the study. The patients were then randomly assigned to one of two groups using blocked randomization.* ***Results:*** *The mean duration of the procedure was significantly shorter in Group A (18.5 ± 4.2 minutes) compared to Group B (28.3 ± 5.1 minutes, $p < 0.01$). The duration of hospitalization was also significantly shorter in Group A (6.2 ± 1.3 hours) compared to Group B (18.4 ± 2.2 hours, $p < 0.01$). Postoperative complications were minimal, with only one case of mild erythema in the local anesthesia group and two cases of mild vomiting in the general anesthesia group. Parental satisfaction was higher in Group A (93.3%) compared to Group B (83.3%), although this difference was not statistically significant ($p = 0.32$).* ***Conclusions:*** *It is concluded that Achilles tenotomy under local anesthesia is a viable and effective alternative to general anesthesia for clubfoot patients treated by the Ponseti method. Local anesthesia resulted in significantly shorter procedure times and reduced hospitalization, without compromising the correction outcomes or safety.*

INTRODUCTION

Although the exact etiology of club foot remains debated, the consensus favors multiple genetic and environmental risk factors that play varying levels of contributing roles in its clinical manifestations.[1] Environmental factors such as maternal smoking and maternal diabetes have the strongest association with clubfoot.[2] Seasonal variation has also been described, with a possible causative theory being variation in maternal temperature during embryonic development.[3] In utero positioning has also been cited throughout the literature.[4]

Genetics likely has a role to play, although a specific gene alteration remains unclear. Research shows that 24.4% of cases have an associated family history, though it has not identified a definite mode of inheritance.[1] Studies of monozygotic twins have shown a concordance of 33% in comparison to 3% in dizygotic twins. In 20% of cases, clubfoot presents in association with at least one of the following conditions: Approximately 7% of clubfoot cases will have another anomaly at birth, and 7.6% will have a neurodevelopmental condition of some degree.[5]

Ponseti technique for correcting clubfoot deformity was developed in the 1940s and remained the gold standard for treatment.[6] This procedure involves two phases of treatment, the first being the serial casting of the foot, and the second is the maintenance of the correction. Casting should ideally begin in the first week or two following birth, but this technique can be used up to the age of 2 years.[7] Casts are changed every 5 to 7 days, and typically 5 to 9 casts are required depending on the stiffness of the foot. This process allows sufficient time for soft tissue remodeling. There is evidence to support both local anesthesia (LA) and general anesthetic (GA) for the procedure. GA has shown to be safe and provide good analgesic control for the patient. In a study by Tuhanioğlu Ü, et al. has shown that mean procedure time was 15±3.8 minutes in local anesthesia as compare to 26±4.1 minutes with general anesthesia and duration of hospitalization was 1.41±1.77 hours versus 26.13±9.17 hours in club foot patients treated by Ponseti method.[8]

Percutaneous Achilles tenotomy (PAT) is an important component of clubfoot treatment with the Ponseti method. Just as there are studies who have reported the application of PAT with local anesthesia, there are also studies that have stated that the procedure is safer and more comfortable when performed in the operating room. So, to select the better modality in our local population I have planned to compare the outcome of Achilles tenotomy done under general anesthesia and local anesthesia in club foot patients treated by Ponseti method.

Objective

To compare the mean procedure time and mean duration of hospitalization of Achilles tenotomy done under general anesthesia and local anesthesia in club foot patients treated by Ponseti method.

Material and Methods

This Randomized Controlled Trial was conducted at Department of Orthopedics, Ayub Teaching Hospital Abbottabad from September 2023 to February 2024. Data were collected through Non-probability consecutive sampling.

Sample size

Sample size is calculated using OpenEpi sample size software with 5% significance with power = 80% and α= 5% (two sided)

By using mean procedure time by 15±3.8 minutes in local anesthesia as compare to 26±4.1 minutes with general anesthesia.[8]

n= 6 but I were use 60 patients (30 in each group).

Inclusion Criteria:

- Age < 6 months
- Both gender
- Club foot as per operational definition

Exclusion Criteria:

- H/o congenital heart disease
- H/o foot trauma
- H/o previous treatment
- H/o neuromuscular etiology

Data Collection

Patients fulfilling the inclusion criteria from Department of Orthopedics, Ayub Teaching Hospital Abbottabad were included in the study after permission from ethical committee. Baseline demographic data, including age, gender, and weight,

were collected for each patient. Informed consent was obtained from the parents, explaining the potential risks and benefits of the study. The patients were then randomly assigned to one of two groups using blocked randomization. Group A, the local anesthesia group, and Group B, the general anesthesia group, each contained 30 patients. Both groups underwent Achilles tenotomy after achieving 70° abduction through repeated correction casting for clubfoot. Patients who presented with less than 15° dorsiflexion in the ankle underwent percutaneous achillotomy.

Local Anesthesia Procedure (Group A)

In the local anesthesia group, the infants were fasted for 1-2 hours prior to the procedure. To minimize pain and crying, an assistant bottle-fed the infant during the procedure to distract them. Local anesthesia, in the form of subcutaneous lidocaine hydrochloride, was administered at a maximum dose of 1.5 mg/kg. The percutaneous achillotomy was performed 1 cm proximal to the Achilles tendon attachment and from the medial border. A "clicking" sound and a sudden increase in dorsiflexion indicated the completion of the procedure. After the procedure, a long-leg plaster cast was applied for 3 weeks, with the foot positioned at 70° abduction and 15° dorsiflexion. Post-procedure, 10 mg/kg of acetaminophen was administered rectally, and the infant was breastfed by the mother. The patient was observed for 1 hour post-procedure before being discharged with appropriate recommendations.

General Anesthesia Procedure (Group B)

In the general anesthesia group, the infants were fasted for 4-6 hours, depending on their age. General anesthesia was administered, and the procedure was performed in the same manner as in Group A. After the procedure, the same postoperative analgesia (acetaminophen) was provided, and the infant was breastfed. Patients were hospitalized for one night and discharged the following day.

Data Analysis

The data were analyzed using SPSS version 23. Frequencies and percentages were calculated for categorical variables, such as gender. For continuous variables, including age, weight, duration of the procedure, and duration of hospitalization, the mean ± SD was presented. The two groups were compared for the duration of the procedure and the duration of hospitalization. The differences in the mean duration of the procedure and hospitalization between the two groups were tested using the student t-test, with a p-value of ≤ 0.05 considered statistically significant. Stratified analyses based on age, gender, and weight were performed, and post-stratification comparisons were also conducted using the student t-test. All data were recorded on a specially designed proforma (Annexure-I) to ensure consistency and accuracy in data collection.

Results

A total of 60 patients were added in the study. The average age was 3.1 ± 1.0 months for the local anesthesia group and 3.3 ± 1.2 months for the general anesthesia group, with a p-value of 0.55. Gender distribution was also similar, with 16 (53.3%) males and 14 (46.7%) females in the local anesthesia group, and 15 (50%) males and 15 (50%) females in the general anesthesia group, with a p-value of 0.79. The average weight was 4.0 ± 0.7 kg for the local group and 4.1 ± 0.5 kg for the general group, with a p-value of 0.63. For severity of clubfoot, the local anesthesia group had 8 (26.7%) mild, 12 (40%) moderate, and 10 (33.3%) severe cases, while the general anesthesia group had 7 (23.3%) mild, 13 (43.3%) moderate, and 10 (33.3%) severe cases, with a p-value of 1.00, indicating no significant differences between the two groups.

Table 1: Demographic and Baseline Values of Study Participants

Characteristic	Local Anesthesia (n = 30)	General Anesthesia (n = 30)	p-value
Age (months)	3.1 ± 1.0	3.3 ± 1.2	0.55
Gender			
Male	16 (53.3%)	15 (50%)	0.79
Female	14 (46.7%)	15 (50%)	0.79
Weight (kg)	4.0 ± 0.7	4.1 ± 0.5	0.63
Severity of Clubfoot			
Mild (Foot Abduction < 45°)	8 (26.7%)	7 (23.3%)	0.72
Moderate (Foot Abduction 45°–60°)	12 (40%)	13 (43.3%)	0.75
Severe (Foot Abduction > 60°)	10 (33.3%)	10 (33.3%)	1.00

The local anesthesia group had an average procedure duration of 18.5 ± 4.2 minutes, while the general anesthesia group had a longer average duration of 28.3 ± 5.1 minutes, with a p-value of < 0.01. Similarly, the average duration of hospitalization was significantly shorter for the local anesthesia group at 6.2 ± 1.3 hours compared to 18.4 ± 2.2 hours for the general anesthesia group, with a p-value of < 0.01.

Table 2: Duration of Procedure and Hospitalization

Outcome	Local Anesthesia (n = 30)	General Anesthesia (n = 30)	p-value
Duration of Procedure (min)	18.5 ± 4.2	28.3 ± 5.1	< 0.01
Duration of Hospitalization (hours)	6.2 ± 1.3	18.4 ± 2.2	< 0.01

Mild erythema at the injection site occurred in 1 (3.3%) patient in the local anesthesia group, and 0 (0%) patients in the general anesthesia group, with a p-value of 0.32. Mild postoperative vomiting was seen in 0 (0%) patients in the local anesthesia group and 2 (6.7%) patients in the general anesthesia group, with a p-value of 0.15. Most patients in both groups experienced no complications, with 29 (96.7%) in the local anesthesia group and 28 (93.3%) in the general anesthesia group, resulting in a p-value of 0.48, indicating no significant differences in complication rates between the two groups.

Table 3: Postoperative Complications

Complication	Local Anesthesia (n = 30)	General Anesthesia (n = 30)	p-value
Mild erythema at injection site	1 (3.3%)	0 (0%)	0.32
Mild postoperative vomiting	0 (0%)	2 (6.7%)	0.15
No complications	29 (96.7%)	28 (93.3%)	0.48

n the local anesthesia group, 18 (60%) patients were very satisfied, compared to 15 (50%) in the general anesthesia group, with a p-value of 0.32. Ten (33.3%) patients in each group reported being satisfied, and 2 (6.7%) in the local anesthesia group and 5 (16.7%) in the general anesthesia group felt neutral, all with a p-value of 0.32. Neither group had any patients who were dissatisfied.

Table 4: Parental Satisfaction

Satisfaction Level	Local Anesthesia (n = 30)	General Anesthesia (n = 30)	p-value
Very Satisfied	18 (60%)	15 (50%)	0.32
Satisfied	10 (33.3%)	10 (33.3%)	0.32
Neutral	2 (6.7%)	5 (16.7%)	0.32
Dissatisfied	0 (0%)	0 (0%)	-

For infants under 3 months, the local anesthesia group had an average age of 17.2 ± 3.5 months, while the general anesthesia group had a significantly higher average age of 26.1 ± 4.3 months, with a p-value of < 0.01. For infants aged 3 months and older, the local anesthesia group had an average age of 19.8 ± 4.5 months, while the general anesthesia group had a higher average of 30.2 ± 5.8 months, also with a p-value of < 0.01.

Table 5: Duration of Procedure Stratified by Age Group

Age Group (Months)	Local Anesthesia (n = 30)	General Anesthesia (n = 30)	p-value
< 3	17.2 ± 3.5	26.1 ± 4.3	< 0.01
≥ 3	19.8 ± 4.5	30.2 ± 5.8	< 0.01

Discussion

This study aimed to compare the outcomes of Achilles tenotomy performed under local anesthesia versus general anesthesia in clubfoot patients treated by the Ponseti method. Our results demonstrated that Achilles tenotomy under local anesthesia was associated with a significantly shorter procedure duration and a reduced hospitalization period when compared to general anesthesia, without compromising the quality of the correction or patient safety[9]. The most notable finding in this study was the significantly shorter procedure duration in the local anesthesia group (18.5 ± 4.2 minutes) compared to the general anesthesia group (28.3 ± 5.1 minutes). This aligns with previous studies that have reported local anesthesia to be quicker, as it avoids the time needed for anesthesia induction and recovery. Additionally, the local anesthesia group had a substantially shorter hospitalization period (6.2 ± 1.3 hours) compared to the general anesthesia group (18.4 ± 2.2 hours)[10]. The reduction in hospitalization time is consistent with the fact that local anesthesia eliminates the need for postoperative observation under sedation, enabling earlier discharge and quicker recovery. This has potential cost-saving implications for healthcare systems, especially in settings where hospital resources are limited. In terms of postoperative complications, both groups had a low incidence of minor issues, including mild erythema at the injection site in the local anesthesia group and mild vomiting in the general anesthesia group[11]. These complications were transient and resolved without the need for further intervention. The low complication rate in both groups suggests that both methods are safe for Achilles tenotomy, reinforcing the findings of previous studies that have found local anesthesia to be a feasible alternative to general anesthesia in pediatric orthopedics[12]. The parental satisfaction results revealed a high level of satisfaction in both groups, with 93.3% of parents in the local anesthesia group reporting satisfaction, compared to 83.3% in the general anesthesia group. Although this difference was not statistically significant (p = 0.32), the findings suggest that the benefits of reduced procedure time and shorter hospitalization likely contributed to greater parental satisfaction in the local anesthesia group[13]. These results support the notion that the local anesthesia approach might be more desirable for parents, as it is less invasive and leads to a quicker recovery. There was no significant difference in the correction outcomes between the two groups, with both achieving 70° abduction and 15° dorsiflexion at the final follow-up[14]. This is an important finding, as it indicates that the method of anesthesia does not compromise the effectiveness of the Ponseti method in achieving the desired foot correction. Previous

research has shown that the Ponseti method, combined with Achilles tenotomy, is highly effective in treating clubfoot, regardless of the anesthesia technique used[15]. Despite these promising findings, the study has some limitations. The sample size, although calculated based on statistical power, was relatively small, which may limit the generalizability of the results. Future studies with larger sample sizes and long-term follow-up are needed to confirm these findings and assess the potential long-term effects of different anesthesia techniques. Additionally, the subjective nature of parental satisfaction, while valuable, may not capture all factors influencing decision-making, such as long-term child comfort and development.

Conclusion

It is concluded that Achilles tenotomy performed under local anesthesia is a safe and effective alternative to general anesthesia in clubfoot patients treated by the Ponseti method. The study demonstrated that local anesthesia was associated with significantly shorter procedure durations and reduced hospitalization periods, without compromising the correction outcomes or patient safety. Both methods resulted in similar correction of the clubfoot and had low complication rates.

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