

# The Level of Fibula Osteotomy and Incidence of Peroneal Nerve Palsy in Proximal Tibial Osteotomy

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## INTRODUCTION

Osteotomy of the fibula is an inseparable component of tibial osteotomy and may be performed at different levels. Studies have shown that the site of osteotomy of the fibula contributes to the incidence of peroneal nerve palsy (PNP).<sup>[1-4]</sup> Significant complications were observed in adults who had fibular osteotomy performed 15 cm below the head.<sup>[5]</sup> In a study, the point of division of the common peroneal nerve and innervations of its muscles were within the proximal 82 mm of the fibula.<sup>[6]</sup> A high complication rate is associated with fibular osteotomies in the proximal 15 cm; as a result, this part should be avoided.<sup>[4]</sup>

Therefore, this study compares patients whose fibular osteotomies were performed in the proximal half of the shaft, with those who had osteotomy in the distal half, in children.

## MATERIALS AND METHODS

All patients who had proximal tibial osteotomy for the purpose of correcting genu varum were eligible for inclusion in the study. Patients with sickle cell disease were excluded from the study. Patients were allocated to Groups 1 or 2 based on the site of the fibular osteotomy. Documented neurological assessment of the integrity of the peroneal nerve was conducted by an independent investigator. Patients from Group 1 had osteotomy of the fibula performed in the upper half of the fibula, while Group 2 patients had osteotomy of the fibula performed in the lower half of the shaft. All operations were performed by the first and second authors or under their supervision. A tourniquet<sup>[7]</sup> was applied at the mid thigh in all patients. The patients were exposed to the same postoperative

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## ABSTRACT

**Objectives:** The level of fibular osteotomy has a role in the incidence of peroneal nerve palsy (PNP). This study aims to compare the prevalence of PNP among patients who had fibular osteotomy at two different levels. **Materials and Methods:** Sixty-nine limbs in fifty-two patients had valgus osteotomy of the proximal tibia and fibular osteotomy at two different levels — the proximal half (Group 1) and distal half (Group 2). The results of these were compared. **Results:** The incidence of peroneal nerve palsy was 23.6 and 3.2% in Groups 1 and 2, respectively ( $P < 0.025$ ). **Conclusion:** This study supports the choice of the distal half for fibular osteotomy.

**Key words:** Fibula-osteotomy, incidence, peroneal-palsy, tibial-osteotomy

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treatment regimen. Their demographic, clinical, and radiological features were noted. The relationship of the incision for fibular osteotomy to the coronal plane was noted. In this study, we tested the hypothesis that osteotomy of the fibula in the upper half of the shaft would be associated with a higher incidence of PNP than osteotomy in the lower half. The primary outcome measure was the number of patients with neurological deficits following osteotomy of the fibula during valgus osteotomy of the proximal tibia. We determined the proposed sample size based on the hypothesis that the incidence of PNP as a primary outcome measure would be 80% higher in those who had fibular osteotomy in the upper half of the shaft. At a power of 90 and 5% significance level the sample size for each group was estimated to be 25. The patients were allocated to Group 1 or 2 based on the site of the fibular osteotomy. Those assessing the presence or absence of complications were blinded to the level of osteotomy, by concealing the detailed operation notes and postoperative X-rays until completion of data collection. The operating surgeons did not participate in the collection of data for each patient. Quantitative data were expressed as means and standard deviation. Proportions were compared using the Chi-squared test. Differences were subjected to two-sided significance tests and were considered significant at  $P < 0.05$ .

## Operative procedure

The patients were admitted at least 24 hours before the day of the operation. Each patient was placed supine. Anesthesia, usually general anesthesia in children, or spinal in those aged above 15 years, was given. Prophylactic antibiotics were given intravenously at induction of anesthesia. Appropriate skin preparation and draping was done. The fibula osteotomy incisions were about 4–7 cm long and placed over the site of the osteotomy. The fibula was exposed subperiosteally and 1 cm of it was resected using a bone cutter. The wound was then closed in layers from the periosteum to the skin without a drain. The tibial and fibular osteotomies were performed via a single incision in 11 patients in Group 1 and through separate incisions in 16 patients in Group 1, and all patients in Group 2. Correction of varus deformity and any associated rotational deformity were performed. The periosteum was repaired over the tibial osteotomy site with vicryl 0. The subcutaneous tissue was repaired with vicryl 2/0 and skin was closed with interrupted nylon 0 stitches. Sterile dressings and a protective above-knee plaster of Paris back slab were applied in all patients.

Postoperative management was similar in all patients and included limb elevation at 30 degrees for five days including analgesia, antibiotics, and so on.

## RESULTS

Fifty-two patients (69 limbs) with genu varum were operated on. Group 1 had 27 patients (38 limbs), while group 2 had 25 patients (31 limbs). The mean age was  $10.4 \pm 2.2$  years in Group 1 and  $11.4 \pm 2.3$  years in Group 2. There were eight males and 19 females in Group 1, while there were 11 males and 14 females in Group 2. Blount disease was the most common indication for surgery in both groups. The baseline demographic and clinical characteristics of the patients are shown in Table 1.

In Group 1, nine patients had peroneal nerve palsy. Of these, only the extensor hallucis longus was paralyzed in eight patients, while all dorsiflexors were affected in one patient who had tibial and fibular osteotomies through the same incision. Out of the nine patients who had peroneal palsy in Group 1, eight had fibular and tibial osteotomies via the same incision, which was anterior to the coronal plane, while one had osteotomy performed through separate incisions, with the incision for fibula osteotomy lying posterior to the coronal plane. In Group 2, there was one case of PNP that affected the extensor hallucis longus. The rate of PNP was 14.5% of the limbs in the entire study

**Table 1: Basic demographic and clinical characteristics of the study groups**

| Characteristic            | Group 1        | Group 2        |
|---------------------------|----------------|----------------|
| Mean age $\pm$ SD (Years) | $10.4 \pm 2.2$ | $11.4 \pm 2.3$ |
| Male: female ratio        | 1: 2.37        | 1: 1.27        |
| Rickets                   | 4              | 2              |
| Blount Disease            | 23             | 22             |
| Osteoarthritis            | 0              | 1              |

group, and 23.6 and 3.2% of limbs in sub-groups one and two, respectively, ( $P < 0.025$ ).

## DISCUSSION

In this study, there was a statistically significant higher incidence of PNP among patients who had fibular osteotomy in the proximal half of the fibula when compared to those who had osteotomy in the distal half. Among patients who had osteotomy in the proximal half, peroneal palsy was more common in those who had osteotomy of the fibula through the same incision used for tibial osteotomy. Such an incision was anterior to the coronal plane as against being posterior to the coronal plane in those who had osteotomy of the fibula through a separate incision. The incidence of PNP was not affected by the severity of genu varum. The higher incidence of peroneal palsy among patients who had osteotomy in the proximal half of the fibula was probably due to the close relationship between the peroneal nerve and the upper half of the fibula. In addition, the muscles responsible for dorsiflexion were long muscles, which received their nerve supply from the peroneal nerve in the proximal half of the leg. Furthermore, it would appear that the use of a single incision for osteotomy of the fibula and tibia was an influential factor in the high incidence of peroneal palsy in Group 1 patients who had osteotomy in the upper half of the fibula. This was so because out of 15 patients who had osteotomy through the same incision eight had peroneal palsy, with one of them involving the entire dorsiflexors, while only one out of 12 patients had peroneal palsy among those who had fibular osteotomy in the upper half through a separate incision. The observation that posterolateral incisions were less often associated with nerve palsy could be related to the expectation that less soft tissue retraction should be associated with the posterolateral incision, which lies behind the coronal plane and directly over the fibula.

The frequent involvement of only the extensor hallucis longus supports the finding that the muscle is supplied by a single branch, which originates at about 99.8 mm distal to the apex of the fibula in 31.7% of the dissected legs.<sup>[2]</sup> In three-quarter of the patients, two-to-three small

branches from the deep peroneal nerve were responsible for supplying the extensor hallucis longus and they may have been damaged during retraction.<sup>[8]</sup> It has also been observed that the nerves enter the muscle from the lateral side and may have numerous small branches.<sup>[3]</sup> Podeszwa and Ebraheim,<sup>[1]</sup> have observed that in cadavers, the peroneal nerve and its branches are at the greatest risk of injury in the upper third of the fibula during osteotomy. These findings support the higher incidence of peroneal palsy in those patients who have had osteotomy of the fibula in its upper half.

We conclude that osteotomy of the fibula in its upper half, in valgus proximal tibial osteotomy for genu varum, is associated with a higher incidence of PNP when compared to osteotomy in its lower half, and that the incidence of PNP is much higher with osteotomy of both tibia and fibula through a single incision. As a result, we wish to advocate that fibular osteotomy during proximal tibial osteotomy, for correction of genu varum, should be performed in the lower half preferably, at the junction between the proximal two-thirds and the distal third. At this point the risk of neurological deficit is insignificant and the stability of the ankle joint is not compromised. However, for those who have a strong reason to perform fibular osteotomy in the proximal half it should be performed through a separate incision, which should be

posterior to the coronal plane. This avoids skin necrosis and anatomically takes the incision behind the peroneal nerve and its branches, which at this point are in front of the coronal plane.

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