

# Treatment of the overriding fifth toe: Butler's arthroplasty is a good option

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## Abstract

**Purpose** The overriding fifth toe is a congenital triplane deformity that may cause aesthetic and functional concerns in children and adolescents. This study aims to evaluate the results obtained when using Butler's arthroplasty to treat this forefoot deformity.

**Methods** We performed a retrospective study, including all patients undergoing Butler's arthroplasty from January 1995 to December 2012. Clinical records were reviewed to determine age at date of surgery, gender, laterality, preoperative symptoms, success of deformity correction, postoperative pain, scarring, need for adapted shoe, rates of complications and recurrence. Patient satisfaction was evaluated through a telephone interview. All  $p$ -values  $< 0.05$  were considered statistically significant.

**Results** A total of 21 patients were included in this study, the majority of which were male (57%), with a mean follow-up of 12 months (1 to 52). In the evaluation of the residual deformity (18 patients), 72% had excellent results, 17% good and 11% poor results. One patient had a keloid scar, three patients reported pain and three patients required adapted footwear. There was a partial recurrence of the deformity in three cases. The majority of patients (78%) were satisfied with the surgery. There was no statistically significant difference in terms of results, when comparing patients older and younger than seven years of age ( $p = 0.46$ ).

**Conclusions** Butler's operation is effective and safe in the treatment of the overriding fifth toe, yielding good functional results and patient satisfaction, with low rate of complications.

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## Introduction

The overriding fifth toe is a congenital malformation of the forefoot with functional and/or aesthetic implications in children and adolescents, causing painful dorsal bursitis, callosities or problems with footwear in 50% of the cases.<sup>1-4</sup> It is bilateral in 20% to 30% of cases and equally affects male and female patients.<sup>1,5-7</sup>

A triplanar deformity at the metatarsophalangeal joint of the fifth toe can be observed, with adduction in the transverse plane, hyperextension in the sagittal plane and external rotation in the coronal plane.<sup>1,2,4,5,8,9</sup> The main aetiological factor is the soft-tissue retraction at the fifth metatarsal-phalangeal joint with dorsomedial subluxation, capsular adhesions at the metatarsal head and a short and adducted extensor tendon. These changes promote the overlap of the fifth toe with the fourth toe, with continual contact with the footwear, which may cause skin lesions or painful callosities in the fifth toe and in the plantar and lateral regions (Fig. 1).<sup>10</sup>

In cases in which disabling symptomatology occurs and shoe modification is not successful, surgical treatment is indicated.<sup>3,4,7,8</sup> Butler's arthroplasty, described by Cockin in 1968,<sup>5</sup> is one of the most commonly used techniques<sup>6,8</sup> because it has shown to efficiently and safely correct the problem, yielding good functional results, with a high degree of patient satisfaction.<sup>1,2,5,6,8</sup>

This study aims to evaluate the results of treatment of the symptomatic overriding fifth toe in a single institution, when using Butler's arthroplasty.

## Material and Methods

We performed a retrospective study, including all patients who had undergone Butler's arthroplasty in our department between January 1995 and December 2012.

Clinical records were reviewed to determine age at date of surgery, gender, laterality, preoperative symptoms,



**Fig. 1** Triplanar deformity of the overriding fifth toe.

success of deformity correction, postoperative pain, scarring, need for adapted shoe, rates of complications and recurrence. Information was obtained through medical records and a telephone interview was conducted by an independent rater. During the telephone interview, the meaning of keloid, hypertrophic and normal scar was explained to patients. The rater was an Orthopaedic Surgery Resident (R. S.) working in a different institution, who had completed a six-month rotation at the senior authors' institution. The rater was not involved in the treatment or clinical follow-up of any patient included in this study.

Residual deformity was classified as: excellent – operated toe similar to the fifth toe of the contralateral foot; good – slightly deviated; poor – recurrence. We also evaluated the results according to the Black Scale, described in the literature to evaluate the outcome of overriding fifth toe surgical treatment.<sup>9,11</sup> The score gives information regarding correction of the deformity, the ability to wear normal footwear and the presence of pain. An excellent result indicates full correction of the deformity, where a patient could wear normal footwear without pain. A good result is obtained when full correction did not occur, although the result is satisfactory to the patient in terms of pain relief and footwear. A poor result is a recurrence of the deformity with a painful toe.<sup>9,11</sup>

Scarring was considered keloid, hypertrophic or normal. A Visual Analogue Scale (0 to 10) was used to evaluate pain, degree of satisfaction of the patient with the surgical intervention and willingness to make a recommendation of surgery to a relative/friend. We also evaluated the need for use of adapted shoes and rates of postoperative complications and recurrence.

The chi-squared test was used with a confidence level of 95%. Statistical significance was set at  $p < 0.05$ .

#### *Surgical technique*

The patient is placed in supine position and is given prophylactic antibiotic therapy (usually cefazolin 30 mg/kg, intravenously). A pneumatic tourniquet is placed on the proximal thigh and inflated 100 mm/Hg above the patient's systolic blood pressure.

A double racquet-shape incision is performed: one circumferential incision at the base of the fifth toe, associated with a shorter dorsal extension over the extensor tendon and a longer extension at the transition of the lateral and plantar border of the foot (Fig. 2).<sup>5,6,11</sup>

Subsequently, a full-thickness (or fasciocutaneous) skin flap is elevated between the two longitudinal incisions to allow later flap sliding. Careful dissection of the circumferential flap is then performed with identification and preservation of the neurovascular bundles and the extensor tendon (Fig. 3).<sup>5,11</sup>

Then, we perform an extensor tendon tenotomy, dorsomedial capsulotomy and detachment of capsular volar adhesions underneath the metatarsal head (Fig. 4).<sup>5,11</sup> A tensionless correction of the deformity is then possible and the toe is brought plantar and laterally aligned with the remaining toes. No internal fixation is used and the skin is sutured with single absorbable stitches, sliding the full-thickness flap from the lateral to the dorsal aspect of the foot to cover the deficit of skin created by the correction of the deformity (Fig. 5).<sup>5,11</sup> The resulting dorsal flap is usually larger than the plantar flap (Fig. 6).<sup>1,11</sup> At this time, the tourniquet is opened and the vascular competence of the toe and flap are evaluated. Postoperative dressings for maintenance of the corrected position are applied for about two weeks<sup>5,6</sup> and the patient can weight-bear as tolerated.<sup>5,11</sup> The average duration of surgery is one hour and the patient is evaluated at two weeks postoperatively in the outpatient clinic (Fig. 7).



**Fig. 2** Double racquet-shape incision.



**Fig. 3** Preservation of the neurovascular structures and the extensor tendon.

## Results

In the period 1995 to 2012, six different surgeons in our institution have surgically treated 21 patients with a symptomatic overriding fifth toe, 12 male (57%) and nine female patients (43%), with a mean follow-up of 12 months (1 to 52). The mean age at surgery was nine years (2 to 19) and seven patients had bilateral pathology (33%). In patients with unilateral disease, there was a slight predominance on the right side (eight patients, 57%).

We were able to perform clinical and functional evaluation in 18 patients. When considering residual



**Fig. 4** Tenotomy of extensor tendon and dorsomedial capsulotomy.

deformity, 13 presented excellent results (72%), three had good results (17%) and two had poor results (11%). When using the Black Scale, excellent results were obtained in 13 patients (72%), good in three (17%) and poor in two (11%) patients. Only one patient (5%) had a keloid scar. Regarding pain, three patients (17%) complained – one patient had grade 4 pain and two patients had grade 3 pain. Regarding footwear, three patients (17%) needed to use a wider shoe. In three patients (17%), there was a recurrence of deformity, with one patient choosing to have another surgical intervention. No other complications were recorded. Most patients (83%) would recommend surgery and are satisfied with their results (78%). Patients who had surgery after seven years of age did not

have a different functional result as per the Black Scale, when compared with patients operated on at an earlier age ( $p = 0.46$ ) (Table 1).

## Discussion

Surgery is indicated to treat the overriding fifth toe when functional and/or aesthetic concerns prevent the use of normal shoes. The deformity may become symptomatic during childhood or cause problems later on, during adolescence.<sup>2,9,12</sup>



**Figure 5** Direct closure with sliding of the lateral fasciocutaneous flap to cover the dorsal region.

Surgery should only be performed after the walking age. Before that, only observation should be done, since some cases may resolve spontaneously.<sup>2,9,12</sup>

From soft-tissue surgery to amputation, several techniques have been described for treating the overriding fifth toe. One of the first interventions described was the transfer of the extensor tendon of the abductor of the little toe (Lapidus 1942<sup>12</sup>)<sup>4</sup> or to the fifth metatarsal neck (Lantzounis 1940<sup>13</sup>).<sup>4</sup> Subsequently, the V-Y plasty described by Wilson in 1953,<sup>14</sup> became a popular procedure for its simplicity, but a high rate of recurrence was noted (Paton),<sup>15</sup> and has not been recommended for treatment of overriding fifth toe. In 1950, McFarland described an intervention which preconized the excision of the proximal phalanx and sindactylization between the fourth and fifth toe.<sup>4</sup> Subsequently, a technique was described by Morris (1982) and Hulman (1964) which associates extensor tendon tenotomy with dorsal capsulotomy.<sup>4,12</sup> Most of these interventions were extremely invasive and difficult to perform, or associated with a high rate of complications, recurrence and high morbidity, and these often outweighed the limitations inherent in the deformity.<sup>6,8</sup>

Butler's arthroplasty (1968) has become a very popular intervention, as it yields good functional results and is considered a technically simple procedure, although it requires careful attention to detail and to surgical dissection, in order to avoid neurovascular injuries.<sup>2,5,6,8</sup> In 1968, Cockin et al<sup>5</sup> described for the first time the intervention attributed to Mr. R. Weeden Butler, who had been performing Butler's arthroplasty since the early 1950s.<sup>1</sup> At



**Fig. 6** Correction of deformity and suture without tension.



**Fig. 7** Fourth postoperative month.

**Table 1** There was no statistical significance between the patient's age and the final result ( $p = 0.46$ )

Age (yrs)	BLACK SCALE			Total
	Excellent	Good	Poor	
> 7	8	2	2	12
< 7	5	0	1	6
TOTAL	13	2	3	18

the time, with a significant sample of 70 patients, they reported that 91% of the cases had excellent results and a rate of only 3% recurrence. In 1985, Black et al,<sup>15</sup> with a sample of 36 cases, reported excellent results in 78% of cases and 6% recurrence.

Later, in 1993, De Boeck<sup>6</sup> reported 23 cases, with excellent results in 74% of cases and 2% recurrence. However, different results have been reported in the recent literature. In 2001, in a study of two institutions with a sample of 48 patients, AbuHassan et al<sup>8</sup> reported 35.1% excellent results and recurrence in 5.4% of cases. In 2007, Gollamudi and Turnbull<sup>3</sup> reported a study with 11 cases, with 54.5% excellent results and 18% recurrence.

In our study, most of the patients were male (57%), which is not consistent with the majority of the literature.<sup>3,5,8</sup> The mean age at surgery was similar to that described in the literature.<sup>5,6,8</sup> We obtained a rate of 72% excellent results, 17% good results and 11% poor results, in agreement with most literature (Table 2).<sup>3,5,6,8,11</sup>

Of note, there is a bias in older studies regarding this matter, since it was the surgeon himself who performed the functional evaluation of the patients.<sup>5,6,11</sup> The authors consider that having an independent rater in this study is an improvement, when considering previous literature. The independent rater was an Orthopaedic Surgery Resident (R. S.) working in a different institution and was not involved in the treatment or clinical follow-up of any patient included in this study. This methodology decreases

the evaluation bias, although we recognize that it may not eliminate it completely, given the fact that the rater has worked with the senior authors.

Our patients had a low rate of complication with respect to healing (one patient with keloid scar) and the presence of vascular lesion (no patient), consistent with that described in the literature.<sup>3,5,6,11</sup>

In our study, most patients were satisfied with the surgery (78%), which is close to that described in the literature (De Boeck – 95%,<sup>6</sup> Gollamudi and Turnbull – 82%<sup>3</sup> and AbuHassan – 100%<sup>8</sup>). Most patients in our study did not need an adapted shoe (14%).<sup>3,6,8</sup>

There was no statistically significant difference between patients older and younger than age seven years regarding the functional results obtained as per the Black Scale, similar to what has been reported in other studies.<sup>3,8</sup>

One of the disadvantages associated with Butler's arthroplasty is its potential for vascular and neurological injury, which may be due to excessive tension in the neurovascular structures.<sup>8</sup> However, in the more than 200 cases described in the literature, no case of neurovascular injury resulting from the intervention is reported.<sup>6</sup> Nevertheless, it is essential to pay attention to detail, avoiding the increase of tension, not applying manipulation or traction, and avoiding the use of rigid or circumferential immobilization.<sup>8</sup>

In this study, a detailed description was performed with intraoperative photographic records of the different steps of the surgical intervention, which is rarely described in the literature. We believe that the fact that patients included in this study have been operated on by six different surgeons is a strength of this study, contributing to improve our knowledge regarding the generalizability of the technique. The patients that we have treated have different characteristics from patients included in previous studies, as toe deformities may have a different impact in different

**Table 2** Results obtained in our study compared with the results described in the literature

Author	N° patients/ N° surgeries	Age (mean)	Follow-up (mean)	Results		
				Excellent	Good	Poor
Cockin (1968) <sup>5</sup>	55 / 70	5 M – 45 Y	1 Y – 10 Y	91% (n = 64)	6% (n = 4)	3% (n = 2)
Black et al (1985) <sup>11</sup>	30 / 36	3 Y – 18 Y (9.6 Y)	16 M – 10 Y (2.3 Y)	78% (n = 28)	12% (n = 6)	6% (n = 2)
De Boeck (1993) <sup>6</sup>	17 / 23	5 Y – 15 Y (8 Y)	1 Y – 7 Y (4 Y)	74% (n = 17)	17% (n = 4)	9% (n = 2)
AbuHassan et al (2001) <sup>8</sup>	36 / 48	4 Y – 14 Y (9.2 Y)	4 Y – 16 Y (10.5 Y)	27% (n = 13)	67% (n = 32)	6% (n = 3)
Gollamudi and Turnbull (2006) <sup>3</sup>	11 / 11	4 Y – 33 Y (15 Y)	3 Y – 13 Y (6 Y)	55% (n = 6)	27% (n = 3)	18% (n = 2)
Our study	21 / 28	2 Y – 19 Y (9 Y)	1 M – 52 M (12 M)	72% (n = 13)	17% (n = 3)	11% (n = 2)

parts of the world, depending on weather conditions and cultural preferences.

We recognize the limitations of this study, due to its retrospective nature and lack of a control group.

In conclusion, in our hands, Butler's arthroplasty proved to be an effective and safe surgical technique for the treatment of the overriding fifth toe in children, allowing good results in terms of function and patient satisfaction, without major complications associated.

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## COMPLIANCE WITH ETHICAL STANDARDS

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### ETHICAL STATEMENT

**Ethical approval:** This research did not involve human participants and/or animals.

**Informed consent:** Not required for this type of study.

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