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## Review Article

# Modified Aglietti procedure (supracondylar femoral osteotomy) for correction of the post-rachitic valgus deformity of the knee in adolescents – A short case series



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## ARTICLE INFO

## Article history:

Received 1 February 2013

Accepted 1 September 2013

Available online 23 October 2013

## Keywords:

Aglietti procedure

Supracondylar femoral osteotomy

Valgus knee

## ABSTRACT

**Introduction:** Supracondylar femoral osteotomy is the time tested method, used for correcting the angular (varus & valgus) deformities at the knee. Traditionally, Coventry type of femoral osteotomy is performed. Here, a medial or lateral based wedge of bone is removed or an open wedge osteotomy is made & subsequently the space is filled with the bone graft to achieve the desired correction. This osteotomy is subsequently stabilized with Kirschner wires or plate & screws. Later the limb is externally supported in brace or plaster cast till osteotomy unites.

Here we present a case series of 10 cases, where we have analyzed the efficacy of Aglietti procedure for achieving normal limb alignment with good patient satisfaction and subsequent knee function as a method of femoral supracondylar osteotomy for correcting the valgus deformity at the knee. Short series results are also encouraging with regard to the operating time, per-operative blood loss, postoperative stability of osteotomy, early starting of postoperative rehabilitation due to good stability at osteotomy & subsequent functional outcome in relation to final range of motion (ROM) – flexion after 6 months of surgery.

**Case series presentation:** Ten valgus adolescent knees were operated in 7 patients by the Aglietti procedure for correcting the angular deformity at the knee. The results were analyzed taking into consideration the desired correction to achieve normal limb alignment, operating time, blood loss during surgery estimated by the number of surgical mops used, stability of the osteotomy in the postoperative period & ultimate range of motion (ROM) obtained at the end of 6 months after the surgery.

**Results:** The age of the patients taken up in the study were in the range of 12–16 years. Females predominated ( $n = 5$ ) against 2 males. The time taken for the procedure ranged from 40 to 50 min. The size of the surgical mops used was  $15 \times 20$  cm. 1–2 surgical mops used per patient. The range of flexion achieved at the end of 6 months after surgery was from 125 to 135°.

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**Conclusion:** In our case series we found Aglietti procedure as an effective and easy method to correct the valgus deformity in post-rachitic adolescent knees with good patient satisfaction and no complications.

However, more number of cases or a randomized control study with comparison between various techniques including Coventry method and a long term follow may be needed to make a final conclusion of establishing the superiority of this procedure over other methods.

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## 1. Introduction

Supracondylar femoral osteotomy is one of the most commonly performed procedures to correct the valgus deformity at knee due to varied etiologies. Coventry<sup>1–5</sup> method of supracondylar femoral osteotomy is commonly practiced worldwide. Here, a bone wedge is removed or an open wedge osteotomy is performed just enough to correct the valgus deformity. Various other forms of similar corrective procedures are available, which have been described by different authors for correcting the valgus or varus deformities at the knee. Here, we analyzed the efficacy of the Aglietti procedure<sup>6</sup> in correcting the valgus deformity in adolescent post-rachitic patients with a good functional outcome.

## 2. Case series presentation

Here, we have analyzed the efficacy of Aglietti procedure for achieving normal limb alignment in valgus deformity at knee along with the operating time, per-operative blood loss, post-operative stability of osteotomy, early starting of postoperative rehabilitation due to good stability at osteotomy & subsequent functional outcome in relation to final range of motion (ROM) – flexion after 6 months of surgery.

Ten adolescent valgus knees (3 patients with bilateral knee deformity & 4 patients with unilateral knee deformity) were selected for the procedure. The patients attended the outpatient Department of Orthopedics & Trauma at NEIGRIHMS, Shillong. The cause of the deformity was found to be post-rachitic in all the patients. We do not found patients with valgus deformity due to other causes like epiphyseal dysplasias, growth plate injuries, growth plate damage due to infections etc., besides rickets. Those who presented with active rickets were treated with vitamin D & calcium supplementation. Vitamin D in the dosage of 60,000 units on alternate day basis with the total of 10 doses along with 200 mg. of elemental calcium daily was given to these patients. In 3 patients, we had to repeat the course of Vitamin D as healing line in the zone of provisional calcification did not appear in them. The outcome of the treatment was followed up with serial serum calcium & bone specific alkaline phosphatase levels & radiological evidence of healing of rickets with occurrence healing line in the zone of provisional calcification in the metaphysis. As, we know that serum alkaline phosphatase level is last to normalize after initiating the management of

rickets, the downward trend along with appearance of the metaphyseal healing line was considered in deciding for undertaking surgical intervention in these patients. Simultaneously, co-existing anemia was also treated, if present. Anemia was found co-existing in 4 patients due to the high prevalence of the nutritional deficiency in this north-eastern part of India. These patients were given iron supplementation for the correction of anemia. Preoperative Long leg radiographic scanogram of the lower limbs with the patient placed supine with internal rotation at hip clinically assessed by greater trochanter being the most prominent and patella and toes facing the ceiling and both the knees touching each other, was performed to assess the deformity and the desired valgus correction (average 6° valgus at knee in bilateral cases & similar to the other knee in unilateral cases). All patients had normal preoperative ROM from 0 to 135°. Patient was



**Fig. 1 – Anterio-posterior radiograph of the knee showing supracondylar femoral V-osteotomy fixed with 2 bone staples.**



**Fig. 2 – Lateral radiograph of the knee showing supracondylar femoral V-osteotomy in sagittal plane fixed by two bone staples.**

placed in supine position and all the operations were performed under general anesthesia & with upper thigh tourniquet in place. A 5 cm long medial paramedian incision was made in line with the medial margin of patella. Superficial & deep fascia was incised. The distal femur was exposed subperiosteally by following the interval behind the medial margin of vastus medialis muscle (subvastus). Growth plate was identified by the leash of epiphyseal vessels & firm adherence of periosteum & confirmed finally by the image intensifier. Drill holes were made in the medial cortex in the

V-osteotomy was completed by osteotome after joining the drilled holes. The bony cortical apex at the medial side of this V was removed with bone-nibbler or rongeur. The medial angular displacement was done in coronal plane to achieve the desired correction. Finally, the osteotomy was stabilized using two bone staples. Wound was closed in layers after securing hemostasis. Tourniquet deflated & the limb was subsequently immobilized in the above knee plaster of Paris cylinder cast. Postoperative lateral & antero-posterior radiographs of the knee showing the V shaped osteotomy fixed with staples have been shown below (Figs. 1 and 2). Postoperative wound inspection was done at 5th postoperative day & suture removal thereafter on 14th day. At 6 weeks, postoperative radiographs were repeated (anterio-posterior & lateral radiographs) to assess any change in the alignment or loosening of staples. Once they were ruled out, rehabilitation in the form of active & active assisted range of motion of knee started with partial weight bearing in brace. The knee brace was discarded at 3 months when all osteotomies were found united. In bilateral cases, osteotomy was performed 3 months after the union was achieved in the previously performed osteotomy. The final assessment of range of motion was done at the end of 6 months after surgery.

### 3. Results

The age of the patients taken up in the study were in the range of 12–16 years. Females predominated ( $n = 5$ ) against 2 males. The time taken for the procedure ranged from 40 to 50 min. The size of the surgical mops used was  $15 \times 20$  cm. 1–2 surgical mops used per patient. The range of flexion achieved at the end of 6 months after surgery was from 125 to 135°. There was no case of wound infection and all wounds healed well. The correction achieved was average 6° valgus at the knee in bilateral cases and similar to other knee in unilateral cases.

The data distribution of the patients in the study is shown below in the table;

Data distribution							
Patient no.	Age (years)	Sex	Operating time (min)	Nos. of sponges size- 15 × 20 cm used	Preoperative valgus angle (degrees)	Postoperative valgus angle (degrees)	Post 6 months ROM (Flexion in degrees) using goniometer
1	16	F	40	1	30	6	0–125
2	14	F	45	2	25	5	0–125
3	15	F	40	1	35	6	0–130
4	16	M	40	1	40	6	0–135
5	12	F	50	2	35	6	0–135
6	13	M	45	2	25	5	0–135
7	12	F	50	2	20	5	0–135
8	16	F	45	1	30	6	0–130
9	14	F	45	2	35	6	0–135
10	15	F	40	1	40	6	0–130

V-fashion in sagittal plane with the apex of V proximal to the growth plate. Fluoroscopy was used to ensure the apex of this V-osteotomy to lie proximal to the growth plate and avoid subsequent growth plate injury and growth disturbance.

### 4. Discussion

Deformity correction is required when the valgus deformity at the knee is more than 12–15° or the plane of the knee joint

deviates from horizontal by more than  $10^\circ$ .<sup>7</sup> Coventry method of distal femoral osteotomy is widely practiced throughout the world. Here a wedge of bone is removed from distal femoral metaphysis based on the measurement on preoperative roentgenograms, to achieve desired correction of the angular deformity. Subsequently it is fixed with internal fixation device using plates & screws or crossed K-wires. Similarly various such procedures are described by various authors like Mc Dermott et al,<sup>8</sup> Healy et al,<sup>9,10</sup> Debeyre et al.<sup>11</sup> The efficacy of Aglietti procedure, a method of supracondylar corrective femoral osteotomy for valgus deformity at the knee described in 1987 was analyzed in our short case series. In their method, Aglietti et al described a supracondylar femoral osteotomy in which the osteotomy is V-shaped in the sagittal plane with its apex just superior to the femoral condyles. They believed this osteotomy has advantages that no internal fixation is needed & alignment can be adjusted in the postoperative cast. We performed the same procedure in case of adolescent patients with valgus deformity of the knee. However, we used titanium staples as the supplemental mode of internal fixation in conjunction with the plaster of Paris cast, to circumvent the likelihood of loosening the correction achieved due to more deforming forces as mentioned in the description due to adolescent age of the patients in our study. Moreover, staples were easy to use, less time consuming & a dependable method for achieving additional stability at the site of osteotomy. The short term results obtained in our series of 10 cases in relation to the total time required for the procedure, average perioperative blood loss & subsequent recovery of range of motion of the knee, are quite encouraging.

## 5. Conclusion

Nutritional rickets is still the major cause of angular deformities at the knee in developing countries especially India. Majority of orthopedic surgeons come across this problem quite frequently in their practice. We conclude that the Aglietti procedure of supracondylar femoral osteotomy is easy to perform, less time consuming procedure with little morbidity for achieving normal limb alignment and subsequent functional outcome for valgus deformity in such patients. This small case series has used a simple methodology of assessing the final outcome of the procedure by deformity correction and establishing good functional range of motion of

the knee. The aim was to highlight the basic procedure which can be performed easily and does not require a specialized set up and can easily be practiced, with minimal internal stabilization of the osteotomy using bone staples and plaster of Paris application, for the correction of the angular deformities of the knee. Not much literature is available on this easy to do procedure and so further evaluation is required to assess its comparative efficacy in relation to other available methods for correction of such deformities.

## Conflicts of interest

The author has none to declare.

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