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Osteosynthesis by Gamma Nail on Ordinary Table: Realization Technique and Results

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ABSTRACT

Authors report the results of a series of osteosynthesis by the gamma nail performed on an ordinary radio-transparent operating table. The aims were to highlight the tricks of our technique for its realization, and to analyze the results obtained.

53 osteosynthesis with gamma-2 nails were performed on a regular, radio-transparent table in 31 females and 22 males. The mean series age was 54.3 years old. According to AO Classification 16 fractures were of type 31A1, 24 of type 31A2, and 13 of type 31A3.

We analyzed the following data: epidemiological parameters (etiology, ASA score); intervention and scopic irradiation duration; the qualities of reduction and osteosynthesis; the dimensions of the implant used; peroperative and postoperative complications; the need for blood transfusion; stand up and consolidation .

Fractures were secondary to a fall from height (32 cases), a road accident (17 cases), and a pathological fracture (04 cases). The surgery duration average was 42 minutes and that of the irradiation due to the scopy varied between 50 and 75 seconds. The nail with 130 ° angulation and the 90mm cephalic screw were the most used. Osteosynthesis was correct in 90% of cases. We deplored 15% reduction defects and eight cases of technical error.

The early complications were 02 cases of secondary diaphyseal fracture 05 cases of hematoma, 01 case of superficial sepsis. No case of blood transfusion was necessary. Consolidation was achieved between 10 to 12 weeks.

The mechanical complications were: sweep of the cephalic screw (1 case), vicious callus (3 cases). Parker's mean score was 7.8 points at 6 months postoperatively.

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The results of this osteosynthesis on a radio-transparent ordinary table gave us encouraging radiological and functional results.

Keywords: gamma nail, ordinary radio-transparent table

INTRODUCTION

Osteosynthesis by gamma nail is the gold standard in the treatment of trochanteric fractures.

For its biomechanical properties the gamma nail allows an earlier recovery of the autonomy to walk. The osteosynthesis by gamma nail is conventionally performed on an orthopedic table with image intensifier.

Its using required some equipment including aimage intensifier and an orthopedic table. In our working conditions in underdeveloped countries, we haven't orthopedic table despite the existence of image intensifier.

We report, in a retrospective study, the results of a series of gamma nail osteosynthesis performed on radiolucent standard operating table.

The objectives were first to highlight the tricks of our operative technique allowing its realization on a regular table; then to judge the interest of its perpetuation in our working conditions through an analysis of the results obtained.

I – PATIENT AND METHOD

From June 2010 to April 2016, 53 osteosynthesis by short Gamma nail were performed on a radiolucent standard operating table.

The gamma nail used was gamma t standard wo11/180 with variable angulations (125 °, 130 °, 135 °).

According to the AO classification [1], 31-B and 31-C type fractures were excluded. Preoperative planning was essential. From the face pelvis x-ray, the cervico-diaphyseal angle and the proximal and distal medullary canal diameter were measured. In proximal it is measured from a horizontal line passing at the lower edge of the small trochanter. In distal it is measured froma horizontal line passing 15 cm below the small trochanter. These measurements allowed us to determine the angulation of the nail to be used and to predict a bone channel.

The patient was placed supine on an ordinary transparent operating table, the trunk inclined controlateral side to the traumatized hip, with a block under the pelvis (sacroiliac). The lower limb in traction stuck in the axis with a weight equivalent to 1 / 10th of the body weight. The healthy hip was positioned in hyper flexion, abduction and external rotation with the knee flexed 90˚ on a Guepel support in order to be able to install the imageintensifier **(Figure 1).** The reduction of the fracture site was made by external maneuver under scopic control. It was performed by an assistant operator who exercised a secondary traction in the axis of the

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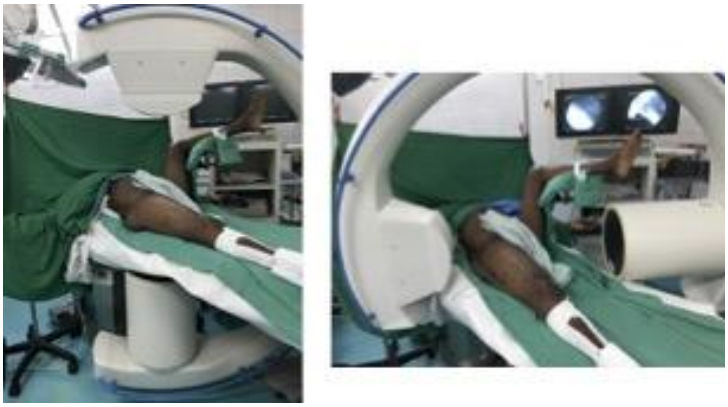
abduction or hip adduction limb with a rotation (internal or external) of 10 to 15 °. The bore was not systematic. The nail guide was first introduced under scopic control. Then we introduced the GAMMA endomedullary nail with the nail guide. The next step was the placement of the cervico-cephalic screw with compression of the fracture site. At this stage, the operator assistant controls the rotation by positioning the ball joint (generally at the zenith). Distal locking of the nail was performed before ending with the locking of the cervico-cephalic screw. The reduction made by the aid occurred at the time of the cephalic aim; compression and distal locking. The closure was performed without aspiration redon drain.



Installation on radio transparent ordinary table.image intensifier positionning

Postoperatively, an ice bladder was placed locally (approach). Antibiotic prophylaxis started peroperatively was continued during 48 hours, analgesics and anti-inflammatory drugs were administered in the absence of contraindications. Anticoagulants also continued for at least 4 weeks. All were put on charge with full support (protected or not) from 48 hours depending on stability. Systematically a control radiological assessment was performed in the immediate postoperative (pelvis face radiography andhip operated face and profile radiography) **(Figure 2).**Patients were reviewed every month until consolidation. We took into consideration some epidemiological parameters (age, sex, etiology, ASA score [2]), duration of the intervention (from skin incision to closure), duration of scopic irradiation, reduction and osteosynthesis qualities, dimensions of the implant used, the peroperative and postoperative complications, the need for blood transfusion and the loading and consolidation times. A functional evaluation was performed at 06 months postoperatively according to the Parker's score [3]; and 18 months of decline according to Postel Merle d'Aubigné (PMA) [4].

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Figure 2: Standard x-ray fracture type 31-A1. Postoperative control frontal incidence

RESULTS

The series included 22 men and 31 women; The average age was 54.3 years with extremes of 26 up to 81 years. The etiologies were: 32 cases of falling from its height, 17 road accidents, and 04 metastatic pathological fractures. According to the classification of OA [1] (proximal femur = 31), there were 16 cases of type 31A1, 24 cases of type 31A2, 13 cases of type 31A3.

We had 60.6% unstable fractures

Only 13 patients had a high ASA [2] risk (ASA 3 and ASA 4). The nail with a 130 ° angulation and the 90 mm cephalic screw were the most used **(Table I and Table II).** The average duration of the procedure was 42 minutes with extremes ranging from 37 to 65 minutes. The duration of irradiation by scopie varied between 50 and 75 seconds. On 15patients, we used boring.

Tableau I: Angulation distribution according to number

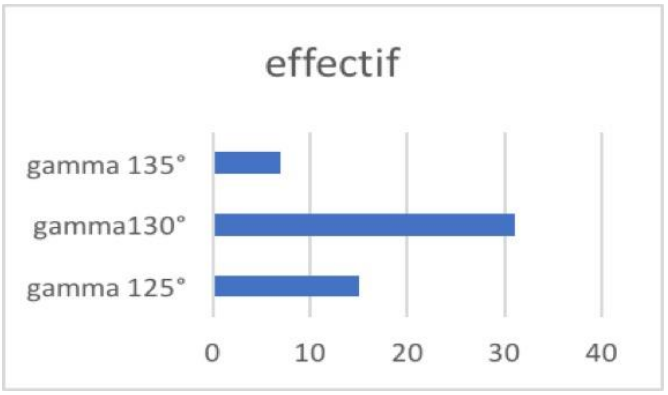

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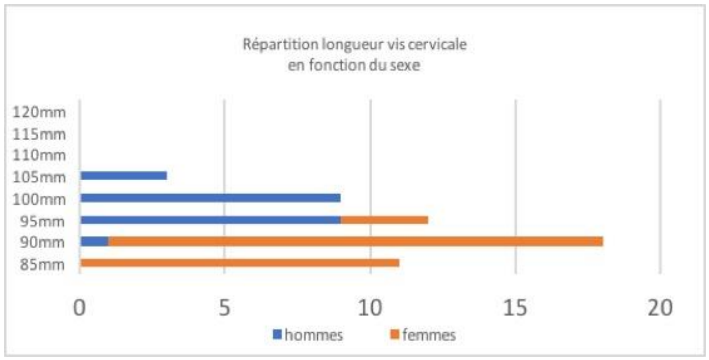
Tableau II : Cervical screw length distribution according to gender



In our series we had 02 (3.77%) cases of poor reduction **(Table III)** and at least 90% (48 cases) of osteosynthesis with correct montage**(Table IV**).

Eight cases (15%) of technical errors, including 03 cases of cephalic screwmalposition, 04 cases of distal locking defect , 2 cases where the cephalic screw was inadequate length (**Figure 3**). Peroperatively we noted 02 cases of diaphyseal splitting. No case of blood transfusion was necessary. The duration of hospitalization was 03 days on average with extremes ranging from 02up to 06 days. We observed 05 cases of hematoma, 01 cases of superficial sepsis. No case of early surgical revision.

Table III: Distribution according to reduction quality

		effective	**Percentage %**
Reduction quality	anatomical	45	84,90
	acceptable	06	11,32
	poor	02	03,77
TOTAL		53	100

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Table IV: Distribution according to the osteosynthesis quality

Osteosynthesisquality		**Effective**
Point of nail penetration	Correct	48
	Shifted	03
	Bad	02
cervicalscrew position	Correct	49
	Anterior	02
	Posterior	01
	Superior	00
	Inferior	01
Distance between line and screw head	Correct	48
	Reduce	03
	Important	02
Distal locking	Correct	49
	Defect	03

Figure 3: Examples of technical errors: distal locking fault (screw too long, screw too high). Postoperative control, face incidence

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Twenty-three patients (43.39%) were put in charge with a complete unprotected support by the 48th hour. In 30 patients (56.60%) this complete support was protected by a walking frame or crutches.

Forty-one patients (77.35%) consolidated within a usual delay (10-12 weeks). As late complications we noted 01 case of cervical screw sweep and 08 cases of malunion including 04 in varus and 04 rotational disorders (03 in external rotation, 01 in internal rotation). No case of pseudarthrosis, no case of cephalic necrosis or material failure were observed.

The average Parker's score [3] was 7.8 points at 6 months of the surgery.

At the minimal follow-up of 18 months, 43 patients (2 deaths, 8 lost to follow-up) were reviewed, of whom 41 seemed very satisfied or satisfied and 2 were little satisfied. The mean PMA score was 16.90 (**Table V**). Two patients had a limb length discrepancy of less than 10 millimeters. Among the rotational disorders observed only one patient (malunion in internal rotation) was hampered.

Table V: Distribution according to the PMA score

PMA score	Effective	Percentage %
Excellent (18)	16	37.20
Good (15-17)	21	48.88
Average (12-14)	05	11.62
Bad(12)	01	02.32
TOTAL	**43**	**100**

DISCUSSION

The GAMMA nail represents one of the last advances in the treatment of fractures of the trochanteric massif because it realizes a stable dynamic assembly allowing an earlier recovery of the autonomy to walk.

Its use requires some equipment including aimage intensifier and an orthopedic table. In our working conditions, not having an orthopedic table, we began this series of osteosynthesis with

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the gamma nail on the ordinary operating table radiolucent thanks to a particular installation of the patient and a certain trick.

The various stages of the operative technique described by Taglang [5] are respected during this osteosynthesis on an ordinary radio-transparent table. By helping us with manual traction, our trick was to change the timeline. Thus, the distal locking of the nail was first carried out before the locking of the cervico-cephalic screw already in place. It is at these two important stages that the external manual maneuvers of the aid intervenes (traction, reduction). It turns out that this maneuver is not permanent throughout the intervention. The interest is to achieve an "early primary" stabilization of the fracture in order to avoid the exhaustion of the aid which maintains the traction in replacement of the orthopedic table.

Our particularity is first of all linked to the use of an ordinary radio-transparent table with a modification of the step chronology . Boring was necessary on young subjects who were the majority of our series.

Thanks to its biomechanical properties the gamma nail allows an earlier recovery of the autonomy to walk as it was the case in all our patients from a complete early support. Then, because of its endomedullary position the gamma nail achieves a stable dynamic assembly by reducing the lever arm at the level of the femoral neck compared to a plate attached to the lateral cortex [6,7]. This dynamic stability allows early loading for the different types of trochanteric fracture (stable or unstable). This is the reason why all our patients were put in support from the 48th hour without hesitation.

In our series, the duration of irradiation with scopie is greater than that reported in the literature [8]; this could be explained by the use of the orthopedic table and especially a large experience curve.

In terms of reduction quality and osteosynthesis ,or complications , our results are encouraging. The defects (of reduction or osteosynthesis) or the errors observed can not be related neither to the use of the ordinary table nor to a modification of the operative technique (installation-intervention) because they are also observed in other series using an orthopedic table [8,9].

Nevertheless the rate (of technical errors, defects) could be reduced gradually by a learning curve of the whole surgical team. The results of our series confirm favorable data from number of studies [10,11,12] with gamma nail in terms of: short intervention duration; less blood loss; short hospital stay. In terms of complications (late) our results are similar to the series performed on an orthopedic table.

We did not use blood transfusion because the bore was not systematic (therefore less blood loss). Moreover osteosynthesis by the gamma nail is a closed surgery (respects the fracture hematoma).

At the functional plan, our results are satisfying; several authors [12,13,14] also found good functional results even though they did not use the same evaluation index.

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CONCLUSION

The realization of osteosynthesis by the gamma nail on an ordinary radiolucent operating table gave us encouraging radiological and functional results. From another installation and tips this type of osteosynthesis could be realized in our working conditions (without orthopedic table). It should therefore be promoted because it is a method of osteosynthesis quite advantageous for its biomechanical properties and closed surgery.

Conflicts of interest

The authors declare no conflict of interest

Contributions of the authors

All the authors cited above participated in the development of this work. All declare that they have read and approved the final version of this manuscript.

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