



## Original Article

# Comparative analysis of treatment of basicervical femur fractures in young adults with CCS, DHS, and PFN<sup>☆</sup>



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## ABSTRACT

**Objective:** To the best of the authors' knowledge, no studies in the literature have compared the clinical outcome of the three most common implants used to treat basicervical fractures of the femoral neck in young adults, i.e. CCS, DHS, and PFN. The present study attempts to fill the void in the literature and reach a conclusion regarding the usefulness of these implants in these fractures.

**Methods:** This was a prospective interventional study including 90 patients with basicervical fracture of the neck of femur treated randomly with cancellous cannulated lag screws or dynamic hip screw, with a derotation screw or short PFN.

**Results:** Mean time for fracture union was 14.4, 13.9, and 13.5 weeks and union rate was 93.2%, 100%, and 100% in groups 1, 2, and 3, respectively. The mean Harris Hip Score at the final follow up was similar among all the groups, i.e. 79.4, 82.2, and 81.9 in CCS, DHS, and PFN groups, respectively. The highest proportion of good to excellent results was noted in the DHS group, i.e. 83.3%, whereas it was 73.6% and 80% in the CCS and PFN groups, respectively. **Conclusion:** Multiple cancellous screws do not provide a sufficiently stable construct during fracture healing. PFN, although associated with lesser implant failures than CCS, have a higher incidence of technical errors. DHS provides sufficient stability in well-reduced basicervical fractures in young adults; it is associated with highest fracture union rates and best functional outcome out of the three implants at final follow-up.

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## Análise comparativa do tratamento de fraturas basocervicais de fêmur com CCS, DHS e PFN em adultos jovens

### R E S U M O

#### Palavras-chave:

Fraturas do quadril  
Hastes ósseas  
Parafusos ósseos  
Fraturas do fêmur  
Fixação de fraturas  
Intramedular

**Objetivo:** Tanto quanto é do conhecimento dos autores, nenhum estudo na literatura comparou o resultado clínico dos três implantes mais comumente utilizados para tratar fraturas basocervicais do colo femoral (CCS, DHS e PFN) em adultos jovens. O presente estudo tenta preencher esta lacuna na literatura e chegar a uma conclusão sobre a utilidade desses implantes nessas fraturas.

**Métodos:** Estudo prospectivo de intervenção, incluindo 90 pacientes com fratura basocervical do colo femoral tratada aleatoriamente com parafuso esponjoso canulado interfragmentário ou parafuso de quadril dinâmico, com um parafuso derrotativo ou um PFN curto.

**Resultados:** O tempo médio para a consolidação de fratura foi de 14,4, 13,9 e 13,5 semanas e a taxa de consolidação foi de 93,2%, 100% e 100% nos grupos 1, 2 e 3, respectivamente. A média do Harris Hip Score no seguimento final foi similar entre todos os grupos: 79,4, 82,2 e 81,9 nos grupos CCS, DHS e PFN, respectivamente. A maior proporção de resultados bons e excelentes foi observada no grupo DHS (83,3%), enquanto que foi de 73,6% e 80% nos grupos CCS e PFN, respectivamente.

**Conclusão:** O uso de vários parafusos esponjosos não fornece uma construção suficientemente estável durante a consolidação da fratura. O PFN, embora associado a falhas de implantes menores do que o CCS, apresenta maior incidência de erros técnicos. O DHS proporciona estabilidade suficiente em fraturas basocervicais bem reduzidas em adultos jovens; seu uso está associado às maiores taxas de consolidação de fraturas e o melhor resultado funcional dentre os três implantes no seguimento final.

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## Introduction

Basicervical fractures of femur are relatively rare injuries which account for only 1.8–7.6% of hip fractures.<sup>1,2</sup> Due to their anatomical location, they represent an intermediate form between femoral neck and intertrochanteric fractures. With no clear cut guidelines as to the precise location that marks the basicervical region, many authors consider it to be an extracapsular fracture and others believe it to be an intracapsular fracture.<sup>3–5</sup> Traditionally, most intracapsular neck femur fractures in young adults have been treated with Cancellous Cannulated screws (CCS) whereas intertrochanteric (extracapsular) fractures have been managed well in the past with the Dynamic Hip Screw (DHS). But since the basicervical fractures are an intermediate between them, so a controversy exists whether to use CCS or DHS for stabilization of these fractures. Moreover, these fractures have long been considered to be inherently unstable which makes the ideal choice of implant for their fixation more difficult.<sup>6–10</sup> The recent surge in use of intramedullary devices for fixation of proximal femoral fractures has led some authors to investigate the use of cephalomedullary nails like the Proximal Femoral Nail (PFN) also in basicervical fractures.<sup>11–13</sup>

There have been only a few published reports focusing on the result of surgical management of basicervical fractures in young adults as a separate entity. The mechanism of injury in young patients is usually high energy trauma as compared to low energy in older patients. Moreover, poor bone stock

in older patients makes the management and outcome of basicervical fractures in their age group a completely different scenario. No study has been documented in literature to the best of our knowledge comparing the clinical outcome of the three most common implants used to treat basicervical fractures of neck of femur in young adults, i.e. CCS, DHS and PFN. The present study attempts to fill the void in the literature and help arrive at a conclusion regarding the usefulness of these implants in these fractures.

## Material and methods

The present study was a prospective interventional study carried out in a government hospital in north India from 2010 to 2016 and included 90 patients of basicervical fracture neck of femur treated randomly with cancellous cannulated lag screws (CCS) or dynamic hip screw (DHS) with a derotation screw (DRS) or a short PFN. Inclusion criteria for the study were acute basicervical fractures and patients aged between 18 and 60 years. Patients with compound fractures, significant comminution, infections, unsuitable skin condition, multiple fractures, pathological fracture, age more than 60 years, Singh's index 3 or below, fractures irreducible by closed methods, history of previous hip fracture or hip surgery were excluded from this study. Clearance from the ethical committee of the institution was taken for the study. Informed consent for inclusion in the study was taken from every patient. After initial resuscitation, a detailed history and

thorough physical examination was done followed by relevant investigations and radiologic evaluation. Radiographs of the affected hip in antero-posterior (AP) and lateral views as well as AP view of pelvis with both hips in 15 degrees of internal rotation were taken. After pre-anesthetic checkup and clearance, patients were taken up for surgery as early as possible. Patients were given spinal/epidural anesthesia according to patient's fitness. Surgery was done in supine position in all patients on a standard fracture table with the unaffected limb held in lithotomy position. Consecutively admitted patients with basicervical fracture of femur fulfilling the inclusion and exclusion criteria were operated by the same surgeon using three cancellous cannulated 32 mm lag screws placed in an inverted triangle fashion (group 1) or a 3 hole DHS with a derotation screw (group 2) or a short PFN (18 cm length) (group 3). Choice of implant was done by simple randomization using a random number generator with the surgeon and the patient blinded to the type of implant. Fixation after closed reduction was done as per standard technique described in literature according to allotted group. Cases with reduction not achieved by closed methods, varus malreduction or improper implant positioning were excluded from the study. Postoperatively, static quadriceps and ankle pump exercise were started on the first post-operative day; sitting with support and knee bending on the second day; non weight bearing mobilization was initiated on the third day in all groups whereas toe touch weight bearing was started depending on patient's tolerance. Patients were followed up monthly for the first six months and evaluated clinico-radiologically. If the fracture site showed evidence of union and pain free movements were achieved at the hip, patients were gradually allowed partial weight bearing followed by full weight bearing with crutches up to four months. After six months, patients were evaluated biannually for a period of two years.

In radiological assessment we looked for union, avascular necrosis, coxa vara, absorption of neck of the femur, implant failure and osteo-arthritic changes. Clinical evaluation of results was done using modified Harris Hip Score.<sup>14</sup> The results were classified excellent, good, fair or poor according to points obtained as follows:

Excellent: HHS between 90 and 100; Good: HHS between 80 and 89; Fair: HHS between 70 and 79; Poor: HHS less than 70.

Data obtained was then assessed statistically using Mann-Whitney U test for significance of difference between quantitative data like duration, blood loss, Harris hip scores. Z-score for used for the significance of difference between independent proportions for qualitative demographic data. Applying the null hypothesis the observed difference was considered to be significant if the *p*-value was <0.05.

## Results

A total of 90 patients were initially included in this study. 30 patients were treated with CCS (group 1), 28 with DHS with DRS (group 2) and 32 with PFN (group 3). One patient in group 1 and one in group 2 was lost to follow up due to change in address and/or contact number and were excluded from the study for final evaluation. The study included 56 men and 32 women with a mean age of 47.5 years (range 21-57 years). The most

common mode of injury was by motor vehicle accident followed by fall from height and fall on ground in that order. Mean duration from trauma to surgery was 9.1, 8.9 and 9.2 hours in CCS, DHS and PFN group respectively and this was found to be insignificant statistically (*p* value – 0.72). Mean size of incision was  $2.1 \pm 0.4$  cm in CCS group,  $6.1 \pm 0.9$  cm in DHS group and  $5.3 \pm 0.7$  cm in PFN group. Average duration of surgery was 29.5, 36.1 and 41.9 min whereas mean hemoglobin (Hb) drop was  $1.0 \pm 0.4$  g,  $2.1 \pm 1.1$  and  $1.6 \pm 0.7$  g/dL in group 1, 2 and 3 respectively. The variability in all these parameters amongst the 3 groups was statistically significant (*p* < 0.05). Technical errors were noted to be most frequent in PFN group and these included varus angulation, opening up of the fracture or distal migration of the proximal fragment upon insertion of the nail. These patients were excluded from the study for evaluation of final outcome as per the exclusion criteria. Incidence of post-operative complications was highest in CCS group but this difference was not statistically significant (Table 1). Mean time for fracture union was 14.4, 13.9 and 13.5 weeks and this difference was statistically significant (*p* < 0.01). Union rate was 93.2%, 100% and 100% in group 1, 2 and 3 respectively and this was found to be insignificant statistically (*p* value 0.27). The mean Harris hip scores at 6 months follow up was significantly higher in DHS group (*p* < 0.05) but at final follow up it was similar in all the groups, i.e. 79.4, 82.2 and 81.9 in CCS, DHS and PFN group respectively and it was found to be statistically insignificant. Highest proportion of good to excellent results was noted in DHS group, i.e. 83.3% whereas it was 73.6% and 80% in CCS and PFN groups respectively but this variability was not statistically significant (*p* value 0.15) (Table 2).

## Discussion

In the present study, the incidence of basicervical fractures was more in men as compared to women and mean age was 47.5 years with most common mode of injury being motor vehicle accidents. This was similar to the findings of

**Table 1 – Showing intraoperative and postoperative complications.**

Complications	CCS (n = 29)	DHS (n = 27)	PFN (n = 32)
Superficial infection	0	1 (3.7%)	0
Screw back out	0	1 (3.7%)	1 (3.1%)
Superior cut out	0	0	0
Varus collapse	2 (6.8%)	0	0
Broken screws	1 (3.4%)	0	0
Joint penetration	0	0	0
Non-union	2 (6.8%)	0	0
AVN	0	0	0

**Table 2 – Showing results at final follow up.**

MEAN HHS at	CCS	DHS	PFN	<i>p</i> value
1 month	23.7	24.5	25.1	>0.1
6 months	69.9	78.2	76.5	<0.05
2 years	79.4	82.2	81.9	>0.1

Hu et al.<sup>12</sup> but different from most other studies as they have included basicervical fractures in the elderly in their studies for which treatment modality and epidemiology pattern is different from adult basicervical fractures. Mean size of incision and duration of surgery was least in patients treated with CCS thus leading to the least post-operative fall in Hb in these cases. In patients treated with DHS, although the duration of surgery was less than those treated with PFN, the size of incision was larger and dissection was more than the latter, thus contribution to a slightly more post-op Hb fall in DHS cases. Incidence of technical errors was highest in PFN group. These included fixation in superior placement of lag screw in one case each in DHS and PFN groups, opening up of the fracture while insertion of PFN in one case and distal migration of the head and neck fragment while inserting PFN in one case. Although these cases were excluded from the study for evaluation of the final outcome, the higher number of technical errors in PFN cases probably suggests the need to observe the technicalities of the insertion of implant with greater detail. Incidence of post-operative complications was highest in CCS group which included varus collapse in two cases, broken screws in one case and nonunion in two cases. None of these complications were noted in either of the DHS and PFN groups. These findings were in concordance with the findings of Imren et al.,<sup>15</sup> Blair et al.<sup>16</sup> and Deneka et al.<sup>17</sup> who concluded that fixation strength was higher in DHS and PFN as compared to CCS. Superficial infection was noted in one case in DHS group and was probably due to more extensive dissection as compared to other groups. It resolved with daily dressings and oral antibiotics in 7 days. Screw back out was seen in one case each in DHS and PFN groups. Fracture union progressed normally in these cases and the screws were removed under local anesthesia after union. No case of AVN was noted in our study and this was similar to the findings of most other studies probably signifying that basicervical fractures are extracapsular type of fractures. Mean duration of union was least in PFN group and longest in CCS group and this difference was statistically significant. Mean HHS at six months showed a statistically significant difference between the three groups with DHS group having the best outcome scores and CCS group the least. But at final follow up the difference was not significant showing that the long term outcome is similar in all the three implants.

A probable limitation of our study was the small sample size of the study. A higher number of cases in each group is required for effective comparison and analysis of results.

## Conclusion

Basicervical fractures appear to behave as an unstable extracapsular fracture rather than an intracapsular fracture neck femur. Union was earliest in PFN group, followed closely by DHS and took the longest duration in CCS group. There was a significant difference noted in the size of incision, duration of surgery and drop in Hb levels, all of which were more in DHS group. No significant difference in incidence of complications was observed in all 3 groups. Although initial clinical outcomes scores were better in DHS group, all 3 implants had

similar results at 2 years. However, it is difficult to draw generalizable conclusions from such a small sample size. A larger patient population is probably needed to identify the optimal treatment method for these fractures.

## Conflicts of interest

The authors declare no conflicts of interest.

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