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A comparative study of outcomes of pertrochanteric fracture (AO Type - 31A2) treated with dynamic hip screw & proximal femoral nail

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Abstract
Background: Intertrochanteric fracture, a common fracture in the elderly accounting for almost 30% patients admitted in orthopaedics wards is associated with significant morbidity and a mortality rate as much as 15 -20 % if not properly treated.
Current concept for intertrochanteric fracture fixation is for AO Type 31A1 fracture the choice of implants is DHS while for AO Type- 31A3, the choice of implant is Proximal Femoral Nail. But there is dilemma about the choice of implants between Intramedullary Nail and Dynamic Hip Screw for AO Type 31A2 fracture.
This study was intended to compare the outcome of both DHS & PFN in AO Type 31A2 fracture.
Methods: This study was conducted in Department of Orthopaedics, Sudhamayi Clinics and Hospital) between June – 2011 to May 2013. Sample size was total of 45 with 23 in PFN group and 22 in DHS group, all the patients who were admitted in our hospital with intertrochanteric fracture AO Type 31A2 between May 2010 and May 2011 were considered for this study.
Total of 45 cases was included in the study. 22 cases in DHS group & 23 cases in PFN group. The total of 45 cases was randomly allocated to two groups.
Data was collected primarily through direct patient review & Electronic Medical Record. AO Classification was used for fracture classification, Palmer & Parker Mobility score was used to record Preinjury & Post surgery Mobility status. Jensen Index was used to asses' social functional status.
Results: The change in mobility score was slightly higher in PFN group which was statistically insignificant, Blood loss was significantly low in PFN group.
The mean T SCORE for both group was -2.44. There was no significant difference in post op mobility score.
Conclusion: There was no significant difference between two groups other than more blood loss in DHS group. Average T Score was higher which is suggestive of Bone Fragility.
Level of Evidence: Therapeutic Level II. See Instructions to Authors for a complete description of levels of evidence.

Keywords: pertrochanteric fracture, AO 31A2, DHS, PFN, T score, mobility score

Introduction

The incidence of pertrochanteric femoral fractures has increased significantly during recent decades, and this tendency will probably continue in the near future due to the rising age of the population [1].
Intertrochanteric fracture, a common fracture in the elderly accounting for almost 30% patients admitted in orthopaedic wards is associated with significant morbidity and a mortality rate as much as 15 -20 % if not properly treated [3].
Restoration of anatomical alignment, rigid fixation and early mobilisation of patients should be considered as the standard treatment in this fracture.[2] Operative treatment of extra capsular hip fractures was introduced in the 1950s using a variety of different implants.[15.] Several types of internal fixation devices have gained popularity in the past for the treatment of these fractures. These implants provide secure fixation of the fracture and controlled impaction of the fracture [4]. All of them use a compression screw introduced in the femoral head across the fracture site along with either a plate for fixation to the femoral shaft or a nail for intramedullary fixation.
Because most patients with this fracture have considerable osteopenia, the results depend on the bone quality, fragment geometry, type of reduction, implant design and implant placement. The surgeon can only control the reduction, the choice of implant and its placement [3].
Dynamic hip screw is a time-tested method of fixation of intertrochanteric fracture. Sliding-hip-screw fixation is quick and straightforward, and it utilizes controlled impaction during weight-bearing to stabilize the fracture, thus facilitating healing [9, 10, 11]. But the results of fixation with this device in osteoporotic bone are sometimes unsatisfactory because of failure of the fixation or failure to reestablish acceptable hip biomechanics, most frequent complication being cut out of the screw from the femoral neck [6, 7]. As extensive dissection is needed for the fixation of the side plate to femoral shaft there are additional problems due to intra operative blood loss and chance of wound infection [9, 10].

Proximal femoral nail was developed to circumvent these problems and combines the advantages of intramedullary fixation and the sliding compression screw. The cephalocondylar intramedullary nails have obvious theoretical advantages because of their improved biomechanics with a shorter lever arm leading to a more stable construct of the fracture [5, 8]. Furthermore, the percutaneous technique of insertion may result in less soft tissue trauma and thereby reduce bleeding and the incidence of infection [2].

Current concept for intertrochanteric fracture fixation is for AO Type 31A1 fracture the choice of implants is DHS while for AO Type- 31A3, the choice of implant is Proximal femoral Nail. But there is dilemma about the choice of implants between Intramedullary Nail or Dynamic Hip Screw for AO Type 31A2 fracture.

This study was intended to compare the outcome of both DHS & PFN in AO Type 31A2 fracture.

Materials and Methods

All the patients who were admitted in our hospital with intertrochanteric fracture AO Type 31A2 between May 2010 and May 2011 were considered for this study.

Patients who is Community and household ambulators, more than 50 years with fracture type AO – 3.1.A.2 were included for this study.

Patients who is non-ambulatory, history of fracture or operation of the same hip, history of fracture of the same femur within one year, fracture type AO 31A1 & 31A3 fracture, Neurological deficit in the affected limb and pathological fractures were excluded from this study.

This was a prospective study where patient was randomly allocated to two different groups. Data was collected primarily through direct interview of the patient at the time of review in the outpatient department and secondarily through I.P. case sheets written by the doctors on admission, Out Patient notes, X-rays taken at the time of admission and follow up, Operation notes and notes of the anesthetists, operation theatre utilization register.

45 consecutive cases of pertrochanteric fracture, which were admitted in our hospital, were considered for the study.

The preoperative parameters that were recorded included the age and gender of the patient, side of the fracture, body-mass index, T score (DEXA SCAN) and medical history. The patients were classified into one of three groups, on the basis of the medical history, with use of the system of the American Society of Anesthesiologists [4, 13].

The assessment of mobility of the patient was assessed with the mobility score of Parker and Palmer [12]. The fracture was classified According to AO Classification.

The operation was usually performed within Seven days of admission, in most cases by a senior orthopedic consultant after obtaining informed consent from the patients.

AO classification: 3 1A2

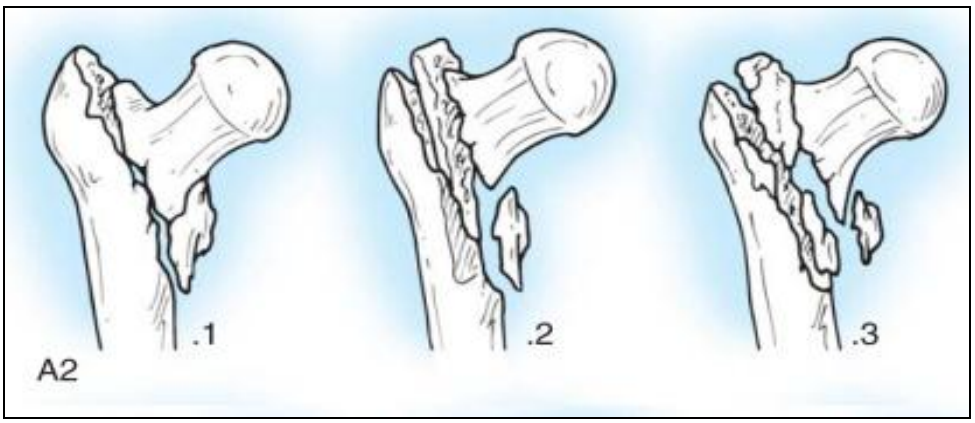

Fig 1: AO/OTA Classification – Type 31A2.1, 2, 3

Operative details

Each patient was given a single-dose antibiotic, cefuroxime 1.5 gm at the time of induction. The method of anesthesia was regional, or general. The anaesthetics was given by a senior resident or consultant anesthetists.

Patients were then transferred to a radiolucent table where closed reduction of the fracture was carried out under image intensifier guidance. A standard operative technique either recommended by the manufacturer or by previous studies was used [3, 15, 16].

The operative time- the length of the operation from skin incision to skin closure and intra operative complications were recorded, as were data pertaining to the type of fixation, including the length of the lag-screw, the angle between the nail and the lag-screw, the diameter of the nail, the length of the plate, and the use of distal locking screws. The position of the lag-screw was assessed fluoroscopically in the lateral and frontal planes [3, 4].

Follow up

Follow-up was at six weeks, twelve weeks, six months and one year post-operatively. Plain anteroposterior and lateral radiographs were taken at each visit and reviewed for fracture union or implant failure. The patient's mobility at six weeks, six months and one year were assessed using the Parker and Palmer mobility score [12].

Pain about the hip and in the mid-portion of the thigh was graded on a 4-point scale (1 point indicated no pain; 2, slight pain that did not affect the ability to walk or necessitate the use of analgesics; 3, moderate pain that affected the ability to walk or necessitated the use of analgesics; and 4, severe intractable pain even in bed) [4].

Statistical Analysis

To test the statistical significance of the difference in mean values of measurable variables between 2 groups student's t-

test was applied. When distribution was found non-normal, Wilcoxon's rank sum test was applied.

For categorical variables, the significance of difference was statistically tested applying Chi-square test.

Radiographs

Fig 2: Radiograph of Pelvis AP view showing Pertrochanteric Fracture AO type - 31A2.2.

Fig 3: Radiograph of Pelvis AP view showing PFN in situ

Fig 4: Radiograph of Pelvis AP view showing Pertrochanteric Fracture AO type - 31A2.3.

Fig 5: Radiograph of Pelvis AP view showing Pertrochanteric Fracture AO type - 31A2.3. Fixed with PFN.

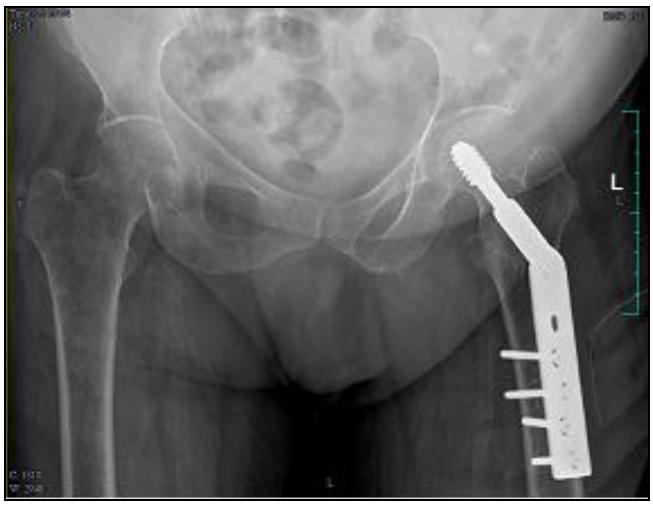

Fig 6: Radiograph showing Pertrochanteric Fracture AO type - 31A2.1 fixed with DHS.

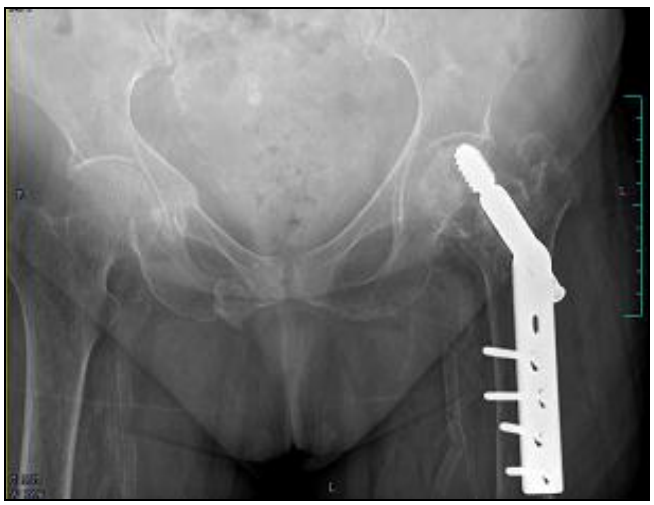

Fig 7: Radiograph showing screw backing out & Cut out through head.

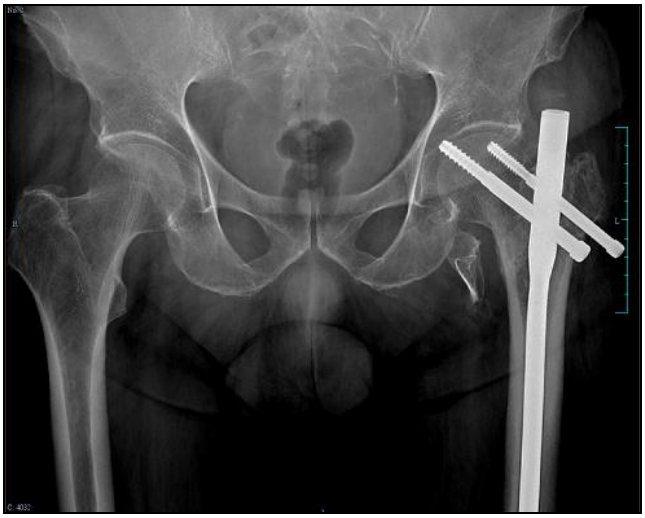

Fig 8: Radiograph of pelvis AP view showing screw back out & penetration to the joint (Reverse Z Effect).

Results

The demographic variables compared between two groups are 43.48% male and 56.52% female in PFN group and 63.64% male and 26.36% female in DHS group with P-Value of 0.170. In PFN group 52.20% fracture was on the right side and 47.80% on the left side, the DHS group 45.50% fracture on the right side and 54.5% on the left side with a P-Value of 0.879. 27.70% of patient was in ASA group –I and 78.30 % was in ASA II, III in PFN group, In DHS group 27.30% was in ASA group-I and 72.7% was in ASA II, III with P-value of 0.932.

The Variables for Fracture type in PFN group AO-31A2.1 & 31A2.2, 31A2.3 were 39.10%, 60.90% respectively. DHS group had 31.80% in AO 31A2.1 and (68.20%) in AO-31A2.2, 31A2.3 with P-value of 0.841, the above demographic variables are depicted in TABLE-I.

The mean Age of PFN group was 66.57. The mean Age of DHS group was 65.73. The mean Pre-Fracture Mobility Score for PFN group was 7.78. The mean Pre-Fracture Mobility Score for DHS group was 8.00. The mean Post op Mobility Score- at 1 yr for PFN group was 5.00. The mean Post op Mobility Score- at 1 yr for DHS group was 5.73. The mean Hospital stay time (in days) for PFN group was 11.65. The mean Hospital stay time (in days) for DHS group was 13.32. The mean Operating time (in minutes) for PFN group was 97.26. The mean Operating time (in minutes) for DHS group was 99.14. The mean JENSEN INDEX for PFN group was 1.57. The mean JENSEN INDEX for DHS group was 1.32. The mean Blood loss (in ml) for PFN was 313.04. The mean Blood loss (in ml) for DHS was 393.18. The mean Blood transfusion (In ml) for PFN group was 136.96. The mean Blood transfusion (In ml) for DHS group was 222.73.

The mean T SCORE for PFN group was -2.278. The T score ranges from -0.9 to -5.0, The mean T SCORE for DHS group was -2.600. Only 9 % was in normal group while 45.5 % had osteopenia & 45.5% had Osteoporosis in DHS Group. Only 4.4 % was in normal group while 69.5 % had osteopenia & 26 % had Osteoporosis in PFN Group. The above data is depicted in Table-II.

Complications rates in PFN group were one patient had DVT, 3 patients had wound infection which needed wound debridement once, one patient had implant failure & two patients Expired within 1 year with medical region, one patient got reoperated & Osteosynthesis was done. In DHS group three patient had wound infection within 1 month for that wound debridement was done, three patients had implant failure for that one patient undergone for total hip replacement & two for Osteosynthesis.one patient expired within 1 year & 2 patient had shortening of more than 2 cm.

In 30.4 % patient of PFN group had TAD more than 25 mm while 18.2 % of DHS group had TAD more than 25mm.the complications are displayed in Table-III & IV.

Table 1

Variable		PFN (23) No. %	DHS (22) No. %	P- value
Sex	Male Female	10 43.48 13 56.52	14 63.64 8 26.36	0.170
Side	Right Left	12 52.20 11 47.80	10 45.50 12 54.50	0.879
ASA	I II & III	5 21.70 18 78.30	6 27.30 16 72.70	0.932
Fracture Type	AO - 31A2.1 -31A2.2 & 31A2.3	9 39.10 14 60.90	7 31.80 15 68.20	0.841

Table 2

Variable	PFN (23) Mean +/- SD	DHS (22) Mean +/- SD	P- VALUE
Age	66.57 +/- 3.342	65.73 +/- 5.257	0.982
Pre-Fracture Mobility Score	7.78 +/- 0.902	8.00 +/- 1.234	0.217
Post op Mobility Score- at 1 yr.	5.00 +/- 1.624	5.73 +/- 1.162	0.135
Change in Mobility Score	2.78 +/- 1.162	2.78 +/- 1.346	0.223
T SCORE	-2.278 +/- 0.7217	-2.600 +/- 0.9730	0.300
HOSPITAL STAY (In Days)	11.65 +/- 6.415	13.32 +/- 6.003	0.259
OPERATING TIME (in min)	97.26 +/- 8.838	99.14 +/- 8.643	0.205
JENSEN INDEX	1.57 +/- 0.590	1.32 +/- 0.477	0.148
BLOOD LOSS (in ml)	313.04 +/- 85.569	393.18 +/-110.513	0.005
BLOOD TRANSFUSION (In ml)	136.96 174.654	222.73 296.699	0.482

Table 3: Complication rates for the patients treated with PFN or DHS.

Complications	PFN (23)	DHS (22)
DVT[$]	1(4.35 %)	0
Infection	3(13.04%)	3(13.63%)
Implant failure	1(4.35 %)	4(18.2%)
Death	2(8.69%)	1(4.54%)
Conversion to THR[*]	0	1(4.54%)
Reoperation with internal fixation	1(4.35 %)	3(13.63%)
Shortening	0	2(9.09%)

[$]DVT- Deep Vein Thrombosis.
[*]THR- Total hip replacement

Table 4: Complications

Variables		PFN (23) No. %	DHS (22) No. %	P - Value
Complications	Yes No	8 34.8. 15 65.2	14 63.6 8 36.41	0.102
TAD[#]	> 25 mm < 25 mm	7 30.4 16 69.6	4 18.2 18 81.8	0.542

[#]TAD (Tip Apex Distance)

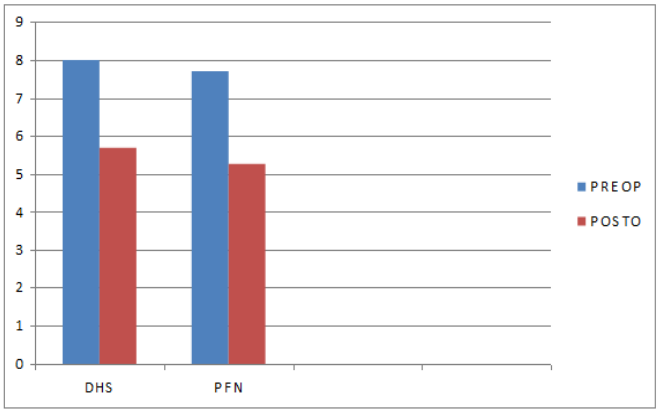

Fig 9

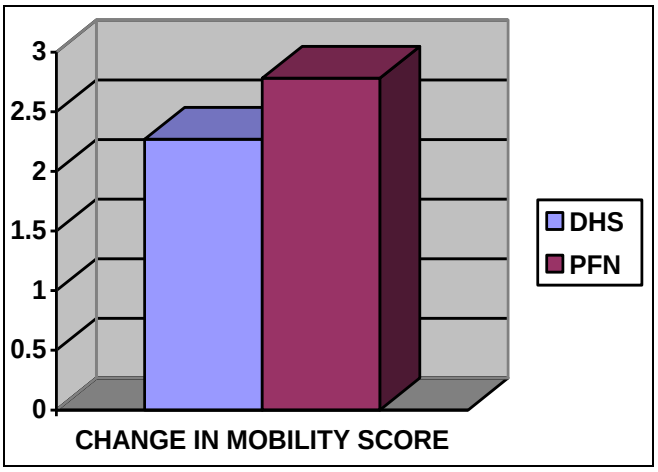

Fig 10: Change in mobility score

Discussion

Intertrochanteric fracture, a common fracture in the elderly accounting for almost 30% patients admitted in orthopedic wards is associated with significant morbidity and a mortality rate as much as 15 -20 % if not properly treated [3].

Restoration of anatomical alignment, rigid fixation and early mobilization of patients should be considered as the standard treatment in this fracture [2]. Operative treatment of extra capsular hip fractures was introduced in the 1950s using a variety of different implants.[17.] Several types of internal fixation devices have gained popularity in the past for the treatment of these fractures. These implants provide secure fixation of the fracture and controlled impaction of the fracture [4]. All of them use a compression screw introduced in the femoral head across the fracture site along with either a plate for fixation to the femoral shaft or a nail for intramedullary fixation.

Because most patients with this fracture have considerable osteopenia, the results depend on the bone quality, fragment geometry, type of reduction, implant design and implant placement. The surgeon can only control the reduction, the choice of implant and its placement [3].

we did prospective, randomized controlled study of outcomes of intertrochanteric fractures in AO Type 31A2, treated with Dynamic hip screw and proximal femoral nailing in terms of, Recovery of pre-injury level of ambulatory status, Post-Operative Medical and wound complications, Length of Hospital stay, need for revision surgery in first post-operative year, mortality rate, transfusion rate In a meta-analysis of to compare the fixation outcome between the sliding hip screw (SHS) and intramedullary nails (IMN) in stable and unstable extra capsular proximal femoral fractures H W Jones [17] analyzed 24 trials involving 3,459 fractures and published their findings in 2005.Regarding screw cut out his observation was that there were no statistically significant differences between the two groups,

In our study, also there was no statistically significant difference in screw cut out, but there was higher number of cut out in DHS group comparing to PFN group.

The comparison between PFN and DHS was evaluated by three trials (Pajarinen 2005; Papasimos 2005; Saudan 2002) in 394 people with trochanteric hip fractures. Both Pajarinen and Papasimos reported a statistically significantly higher median length of surgery for the PFN group (respectively: 55 versus 45 minutes, reported P = 0.011; 71 versus 59 minutes, reported P < 0.05), whilst Saudan found no difference between the two groups (mean difference-1.00 minute, 95% CI -9.14 to 7.14 minutes). Blood losses and transfusion were similar for both groups of Pajarinen. Papasimos reported no statistically significant difference between groups for operative blood loss (265 ml versus 282.4 ml; reported P > 0.05). Though fewer people received transfusion in the PFN group of Saudan (55/100 versus 72/106; RR 0.81, 95% CI 0.65 to 1.01), there was no difference between the two groups in the mean number of units of blood transfused (1.5 versus 1.7 units).

In our study, there was no statistically significant difference in length of surgery, Hospital stay, and Transfusion rate. Jensen index & change in mobility score. But Blood loss was statistically significant higher in DHS group.

A Comparison of the Long Gamma Nail with the Sliding Hip Screw for the Treatment of AO/OTA 31-A2 Fractures of the Proximal Part of the Femur, A Prospective Randomized Trial by Tristan M. Barton [19] *et al.* shown that There was no significant difference between the reoperation rates for the two groups. In total, five patients (three from the long-gamma-nail group and two from the sliding-hip-screw group) underwent revision surgery because of cut-out. Tip-apex distance was found to correlate with the implant cut-out rate.

There was no significant difference between the two groups in terms of the EuroQol 5D outcome scores, the mortality rates after correction for the minimental score, or any of the secondary outcome measures,

In our study, there were four screw cut out in DHS group compare to one screw back out & penetration to the joint (Z effect) in PFN group. Three patients had undergone for reoperation in DHS group compared to one reoperation in PFN group, Total hip replacement was done in one patient in DHS group, compared to no Conversion to Total hip replacement in PFN group. The incidence of Post op wound infection was same in both groups.

Conclusions

Based on the results of the study following conclusions were reached.

1. There was statistically significant difference in the intraoperative blood loss; it was higher in DHS group.
2. There is no statistically significant difference in the operating time between the two groups.
3. There was no significant difference in change in mobility score whether the fracture is fixed with dynamic hip screw or proximal femoral nail.
4. There mean T score for both the groups were high which is suggestive of bone fragility which led to fracture due to trivial trauma.
5. The fracture union rate was not dependent on the type of implant used for fixation of this fracture.
6. There is no statistically significant difference in the complication rate between the two groups.
7. There was one screw back out & penetration to the joint in PFN group, while three screw back out & cut out in DHS group.

Recommendations

Due to the following limitations of the study we were not able to suggest any recommendations but our findings concur with previous studies suggesting that there is no difference between the two fixation devices in the treatment of intertrochanteric fractures except for increased blood loss in DHS group.

Limitations of the study

The two groups were small which decreases the power to assess the association between the many variables considered in the study.

Suggestions

Adequate number of patients depending on the number of variables assessed will increase the power of the study and help in bringing out the exact association between the different variables.

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