

COMPARATIVE STUDY ON THE OUTCOME OF PAUWELLS OSTEOTOMY AND TOTAL HIP REPLACEMENT IN NEGLECTED FRACTURE NECK OF FEMUR IN YOUNG ADULTS

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Abstract--Introduction: Neglected fracture neck of femur remains a challenge for Orthopedicians. Various options are available; each having its own pros and cons. In young adults there is always a dilemma whether to salvage the head and perform osteotomy or opt for radical surgery like THR. The present study was done for a comparative analysis between two procedures: Pauwells osteotomy and total hip replacement and decide which is better opted for our Indian scenario.

Material and methods: 47 cases of neglected fracture neck of femur operated during December 2017– January 2021 were included in this study. Cases were divided into two groups based on the method of surgery, Group 1: Pauwells osteotomy 17 cases and Group 2: THR 30 cases. The comparison was done on the basis of operative and post operative parameters like duration of surgery, blood loss, pain, duration of hospital stay, hip functionality by Harris Hip Score and complications like infection, dislocation, limb length shortening.

Results: On assessing the operative parameters, it was found that duration of surgery was longer and statistically significant in Pauwells osteotomy; along with more blood loss. For the post-operative parameters, the duration of pain was longer and Hb level was less in Pauwells osteotomy which was statistically significant. However the hip functionality as assessed by Harris Hip Score was found to be not statistically significant. Complications like infection and limb length discrepancy was found in Pauwells osteotomy whereas dislocation was seen in THR.

Discussion: There is always a debate whether to salvage the head by doing Pauwells osteotomy or replace it by THR in younger age group patients. Arthroplasty can provide rapid pain relief and better range of motion with less duration of surgery, less blood loss, but Pauwells osteotomy even though has greater complications like infection and limb length discrepancy still has the advantage of preservation of native hip which is useful in squatting and other activities.

Conclusion: Both modalities of treatment i.e Pauwells osteotomy and THR restore the hip functionality in neglected fracture neck of femur; however Pauwells osteotomy has the advantage of preservation of native hip which is an essential requisite for squatting and other hip activities in relatively younger neglected fracture neck of femur patients whereas THR remains indisputable choice in less physically demanding patients

Keywords--Neglected fracture neck of femur, THR, Pauwells Osteotomy, Harris Hip Score

1. INTRODUCTION

Fracture neck of femur is very commonly encountered in day to day practice in every orthopaedic setup. Out of which 2-3% occurs in adults younger than 50 years and is often due to high-energy trauma.¹ This type of fracture has a greater chance of delay of seeking medical help due to poverty, ignorance, lack of facilities or the preference of quacks giving local remedies like desi pattu and sekka. Thus it has a predisposition for becoming 'neglected'. Neglected femoral fracture is said when there has been a delay in medical treatment for more than 30 days from the original injury.²

The treatment of these patients presenting late with complications like non union, avascular necrosis (AVN) and deformities like limb shortening due to resorption of neck becomes a challenge to orthopaedic surgeons.^{1,3} The general approach is total hip replacement (THR) in elderly patients > 60 years; whereas salvage of femoral head is done in younger patients by fixation with muscle pedicle bone grafting, internal fixation with vascularised or free fibular grafting and valgus osteotomy and internal fixation.⁴

THR is not always possible in our Indian Scenario due to limiting factors like increased expenditure, need for expertise and infrastructure and possibility of complications. Hemiarthroplasty is a practiced and valid method, done in relatively advanced age group of patient with a normal acetabulum.^{1,5} Various studies have shown that procedures like muscle pedicle grafting, fibular bone grafting have higher chance of failure and drawbacks.⁶ Hence osteotomy still remains a valid and viable option in young adults to preserve the native joint and to buy time for future replacement procedure if required.

McMurray osteotomy was commonly done earlier. It is a displacement osteotomy, which diverts the line of weight transmission but the shifting causes shortening with laxity of abductors leading to Trendelenburg Positive gait.⁷ Even though it has become outdated and generally not preferred nowadays due to inability to do future hip replacement, still it is a preferred method of management in young adults where replacement is not required.

A better time tested, age old approach to neglected fracture neck of femur is Pauwells osteotomy. Pauwells osteotomy is a closing wedge osteotomy between 30 – 60 degree angle done at inter trochanteric level. This is to make the vertical fracture line more horizontal and leads to better weight bearing.⁸ Thus in young adults (borderline age)

there is always a dilemma whether to opt for Pauwells osteotomy and salvage the head or perform a radical procedure THR.

This study was undertaken to analyze the operative and post-operative parameters about the two approaches for neglected fracture neck of femur done in our set-up i.e. Pauwells osteotomy and THR; and to determine which approach would be more suitable for young adults in Indian scenario.

2. MATERIALS & METHODS:

A retrospective cohort study was done for all the cases of neglected fracture neck of femur operated by Pauwell Osteotomy and by THR from December 2017 to January 2021 in our tertiary care hospital.

2.1 INCLUSION CRITERIA:

47 cases of neglected fracture neck of femur from age ranging 40 – 50 years were selected for this study. The patients were grouped under two groups based on the method of surgery- Group 1- Pauwells osteotomy which included 17 cases and Group 2: THR which included 30 cases.

2.2 EXCLUSION CRITERIA

Patients having bilateral fracture involvement, fracture with features of AVN, fracture neck with trochanteric extension, multiple fractures and those lost to follow-up were excluded from the study.

2.3 SURGICAL PROCEDURE

After informed consent and routine clinical and radiological investigations, patients were prepared for surgery. [Figure 1, 2]



Figure 1: Preoperative Xray



Figure 2: Preoperative Xray

1) 2.3.1 Pauwells osteotomy

Surgery was done in supine position in regular ortho table. The bone was reached after giving incision on the lateral aspect of hip joint extending from tip of trochanter to 10-12 cm distally along the femoral axis. The non union was temporally fixed with 'k' wires. Traction was controlled by assistant manually and intertronschanteric lateral closing wedge osteotomy was performed above the level of lesser trochanter below the slope of greater trochanter measuring around 30-50 degree. The images were checked with IITV (Image Intensifier television). The limb was abducted and fixed with previously placed barrel and plate (if planned for double angle dynamic Hip Screw (DHS) and blade plate in case of double angle blade plate). Distally fixation of shaft was done with 4.5 mm screws. Hemostasis was maintained and wound closed in layers over drain.⁹ [Figure: 3, 4]

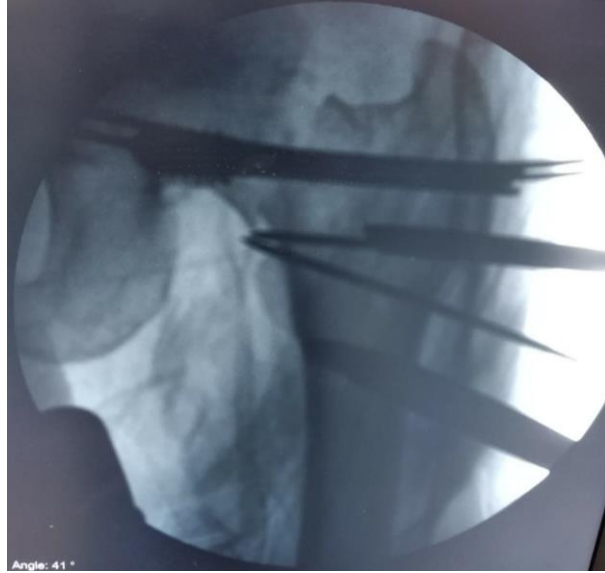


Figure 3: Post-operative Xray

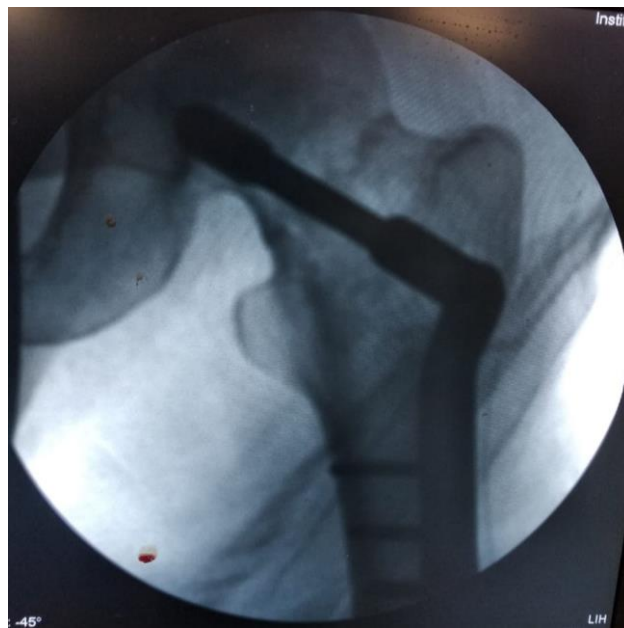


Figure 4: Post-operative picture

2.3.2 Total Hip replacement THR

All patients were operated through mini invasive postero-lateral incision under spinal block in lateral position. The leg was positioned loosely in 30° hip flexion and 60° knee flexion position. Sterile draping was applied. A line is drawn on the skin from lateral femoral condyle to the tip of the greater trochanter; the middle of this line being the new landmark and then joined proximally to posterior superior iliac spine. On this line a perpendicular was drawn to the axis of femur from the tip of the trochanter and the skin incision of 6-8 cm long was made along the oblique posterior iliac line 3-4 cm proximally and 3-4 cm distally to this point. The gluteus maximus muscle is divided and underlying structures reached with the use of self-retaining retractor. Thus the posterior part of neck is reached through short external rotators with hip in internal rotation. Release of iliopsoas from lesser trochanter was done when required. The neck is cut; head is delivered then acetabular preparation done femoral preparation is done; trial implant was tried. Arthroplasty is completed with non-cemented femoral component (modular bipolar). Capsule with rotators was repaired back to the trochanter. Wound is closed over drain.¹⁰ **[Figure 5]**



Figure 5: Post-operative Xray THR

2.4 POST-OPERATIVE CARE

Adequate antibiotic and analgesic coverage was given post operatively in all cases. POP boot and derotation bar was applied for 3 weeks in Pauwells osteotomy patients. Patients were advised to bear weight with support from third week onwards. The weight bearing was gradually increased and support was discarded by 3 months. Hip functionality was assessed at 3 months by Harris Hip Score which is a measure of dysfunction.¹¹ It is divided into 3 sections: section 1 are questions answered by patient about pain and its impact like using support devices, maximum distance walked, limp, ability to put on shoes and socks, ability to use stairs, ability to enter public transportation, ability to sit; section 2 and section 3 are clinical assessment of hip joint i.e absence of deformity (less than 30 degrees fixed flexion contracture, less than 10 degrees fixed abduction, less than 10 degrees fixed internal rotation in extension, limb length discrepancy less than 3.2 cm); and function i.e total degrees of flexion, abduction, external rotation, adduction). Results were interpreted as <70- poor, 70-80- fair, 80-90- good and 90-100- excellent.

2.5 EVALUATION.

The comparison was based on operative parameters like duration of surgery (from skin to skin), blood loss > 100 ml; and post-operative parameters like pain (assessed by patient's requirement for analgesics), post operative hemoglobin (Hb) level, Harris Hip Score and complications like infection, limb length discrepancy and dislocation. Patients were followed for a minimum of 2 years.

2.6 STATISTICAL ANALYSIS

Analysis of data was done by independent t test using SPSS 20 software and Microsoft excel sheet. Data was represented as Mean $\pm$ SD. p value of <0.05 was considered as significant.

3. RESULTS:

The present study included 47 cases of neglected fracture neck of femur which were grouped onto two groups based on the method of operation; Group 1: Pauwells osteotomy (17 cases) and Group 2: Total Hip Replacement (30 cases).

3.1 Pre-operative parameters

The mean age in years of patients in group 1 Pauwells osteotomy was 45.47 ± 2.5 as compared to 45.13 ± 2.6 in group 2 THR patients which was not statistically significant (p value= 0.673). The male: female ratio in Group 1 Pauwells osteotomy was 12 males and 5 females; and in Group2 THR it was 22 males and 8 females.

3.2 Operative parameters

The duration of surgery in min was 111.76 ± 11.8 in Group 1 Pauwells osteotomy as compared to 60.33 ± 6.6 in Group 2 THR; this was statistically significant. (p value= 0.000)

The blood loss during surgery was > 100 ml in 10 cases (58.8%) in Group 1 Pauwells osteotomy and 9 cases (30%) in Group 2 THR.

3.3 Post-operative parameters

The duration of pain was assessed by number of days of requirement of analgesics by the patient. It was found to be 5.88 ± 0.99 days in Group 1 Pauwells osteotomy as compared to 3.53 ± 0.77 days in Group 2 THR which was statistically significant (p value= 0.000)

The post-operative Hb level in gm% was found to be 8.076 ± 0.87 in Group 1 Pauwells osteotomy as compared 9.877 ± 1.01 in Group 2 THR which was statistically significant (p value= 0.000)

Hip functionality as assessed by Harris Hip score was found to be 79.0324 ± 11.37 in Group 1 Pauwells osteotomy as compared to 84.135 ± 8.87 in Group 2 THR which was found to be statistically insignificant (p value= 0.094)

The duration of hospital stay in days was 9.06 ± 0.55 in Group 1 Pauwells osteotomy as compared to 5.20 ± 0.71 in Group 2 THR which was found to be statistically significant (p value= 0.000)

Infection was seen in 5 cases (29.4%) in Group 1 Pauwells osteotomy and 2 cases (6.66%) in Group 2 THR.

Dislocation was seen in 2 cases (6.66%) of Group 2 THR and Limb length discrepancy in 5 cases (29.4%) in Group 1 Pauwell osteotomy. [Table 1]

Table 1: Comparison of preoperative, operative and post operative parameters in Group 1: Pauwells osteotomy and Group 2: THR

Parameter	Group 1: Pauwells osteotomy	Group 2: THR	p value
Age in years	45.47 ± 2.5	45.13 ± 2.6	Not significant (0.673)
Sex	12 M: 5 F	22 M : 8 F	
Duration of surgery in min	111.76 ± 11.8	60.33 ± 6.6	Significant(0.00)
Blood loss > 100ml	10 cases (58.8%)	9 cases (30%)	
Duration of pain in days	5.88 ± 0.99	3.53 ± 0.77	Significant(0.00)
Post op Hb level in gm%	8.076 ± 0.87	9.877 ± 1.01	Significant(0.00)
Harris Hip Score	79.0324 ± 11.37	84.135 ± 8.87	Not significant(0.094)
Duration of hospital stay in days	9.06 ± 0.55	5.20 ± 0.71	Significant (0.00)
Infection	5 cases	2 cases	
Dislocation	none	2 cases	
Limb Length discrepancy	5 cases	none	

4. DISCUSSION:

In fracture neck of femur, patient manages his daily activities either with support or by limping.¹² Different insurance and government sponsored schemes are available which benefit the poor and persons from low socio economic group, still they present late and become neglected. In borderline age group, there is always a debate whether to perform salvage procedure or radical procedure like replacement. In our study we have compared both procedures on various parameters both operative and post operative and interpreted the results for surgery of neglected fracture neck of femur by salvage (double angle DHS/ double angle blade plate) or replacement by THR.

Arthroplasty can provide rapid pain control and fair range of movement.^{7, 13} But preservation of head (salvage) in relatively young age group is important. In osteotomy, the hip preservation is done, hence in patients with physically demanding jobs the functional results after osteotomy are comparatively better.¹⁴

The age group in both groups in our study were 45-50 years since our study is focussed on borderline age group where the debate of osteotomy or THR arises. This is similar to studies which have also performed osteotomy in the younger age group.^{15, 16}

Coming to the comparison of intraoperative parameters in our study, the duration of surgery possessed a significant difference which was 90-120 min (mean 111.76 ± 11.8) in Pauwells osteotomy as compared to 50-70 min (mean 60.33 ± 6.6) in THR. In Pauwells osteotomy, frequent image check and confirmation in IITV and closure of the wound accounted for the significant increase in time duration. Blood loss in Pauwells osteotomy was > 100 ml in 58.8 % cases and it was > 100 ml in 30 % in THR group. This is possibly due to Pauwells osteotomy being an extensive surgery with greater tissue damage. These findings are similar to the study done by Gavaskar et al which showed similar longer time duration of surgery and increased blood loss in Pauwells osteotomy.¹⁷

Pain persisted and required injectable analgesics post-operatively upto 5-7 days (mean 5.88 ± 0.99) in Pauwells osteotomy and for 3-5 days (mean 3.53 ± 0.77) in THR which was found to be statistically significant. The longer duration and more extensive surgery with tissue damage in Pauwells osteotomy may account for post operative persistent pain for longer duration as compared to THR patients who were comfortable after removal of epidural catheter.

Post operatively the haemoglobin level when measured on third post operative day was 7.0 -9.5 gm % (mean 8.076 ± 0.87) in Pauwells osteotomy and 7.5-11.5 gm % (mean 9.877 ± 1.01) in THR; which was statistically significant. The gross muscle injury in Pauwells osteotomy may have accounted for the fall in Hb level which also necessitated the need for either intra-operative or post operative blood transfusion.

For assessing Hip functionality, Harris Hip Score was used which showed a post operative improvement in hip function in both groups. In Pauwells osteotomy, the score ranged from 57.95 – 91 (mean 79.0324 ± 11.37). Limping and limb length discrepancy accounted for a less score. Tian S et al¹⁸ have showed improvement in Harris Hip score upto 93.1 and Magu et al⁶ showed average of 86.7. In THR, the average Harris hip score was 84.135 ± 8.87 which was not statistically significant indicating that irrespective of the nature of surgery, there is definitive improvement of hip function post operatively.

The duration of hospital stay was 8-10 days (mean- 9.06 ± 0.55) in Pauwells osteotomy as compared to 4-6 days (mean- 5.20 ± 0.71) which was statistically significant. Pauwells osteotomy patients preferred to stay more number of days as they were kept on boot n bar splint and wanted to recuperate from the surgery. However in THR the patients were comfortable in walking 3rd/4th post operative day after removal of the drain hence the shorter duration of hospital stay and quicker discharge to home.

5 cases developed infection in Pauwells osteotomy. Out of which 3 cases had discharge from the wound that continued for a longer duration upto 8-10 days. This subsided with increase in the antibiotic duration. In these cases, the stitch removal was delayed. With blood parameters remaining in acceptable limit, we did not feel the need to intervene. In the other 2 cases, the infection persisted with discharging sinus at the mid portion of the incision scar. Initially it was culture positive and after administering sensitive antibiotics, it subsided. However the discharge persisted on and off with culture negative reports but did not require revision surgery. In the study conducted by Gavaskar et al they have observed no deep infection.¹⁷

Dislocation was seen in 2 cases of THR inspite of meticulous repair of posterior structure (i.e posterior capsule and short rotators) intra-operatively. This can be attributed to squatting as a demand of their life style as analysed by Jain A et al.¹

Limb Length Discrepancy was observed in 5 cases out of 17 cases in Pauwells osteotomy. Inspite of gain in limb length in comparison to preoperative status, there was shortening < 2cm in Pauwells osteotomy patients. The gain in length was due to correction in neck shaft angle (from preoperative varus angulation to postop valgus angulation). This is in accordance with Magu et al⁶ and other studies¹⁷ where they observed limb length discrepancy of 1.9cm postoperatively. This was not encountered in THR patients as length was assessed and corrected intraoperatively.

From our study we have observed that both Pauwell osteotomy and THR have their own advantages and drawbacks. Apart from this contemporary literature also suggests that Pauwell osteotomy bears the advantage of restoring the neck shaft angle on the valgus side, hence converts the shearing force of fracture neck to compression force.¹ Osteotomy itself increases vascularity of femoral head and can be indicated in neglected fracture neck of femur without features of AVN and collapse.^{9,19,20} THR prohibits patient from doing certain day to day activities squatting and sitting crosslegged, which is very much essential in younger group.¹ We also observed that younger age with physiologically fit patients did well with Pauwells osteotomy whereas those having relatively less demand from the hip fared well with THR.

5. CONCLUSION

Our study is to enumerate the salient basic yet pertinent parameters associated with management of neglected fracture neck of femur. As in our scenario we commonly encounter neglected fracture neck of femur and we advocate both modalities of treatment i.e salvaging the head of femur or replacement by THR. In our study we found that in Osteotomy, there was increase in blood loss, requirement of blood transfusion, prolonged duration of surgery and longer hospital stay with increased infection. But it

manages to preserve the native hip joint with head of femur and retains a strong impression in the physically demanding patients in our society when done in a relatively younger age group. However, THR still remains an undebatable alternative in older age group and physically less demanding persons.

REFERENCES:

1. Jain A, Mukunth R, Srivastava A. Treatment of neglected femoral neck fracture. Indian Journal of Orthopedics. 2015 January; 29(1): 17-26.
2. Meyers MH, Harvey JP Jr, Moore TM. Treatment of displaced subcapital and transcervical fractures of the femoral neck by muscle-pedicle-bone graft and internal fixation. A preliminary report on one hundred and fifty cases. J Bone Joint Surg Am 1973;55:257-274.
3. Wood GW. General principles of Fracture treatment. In: Canale ST, Beaty JH. (eds). Campbell operative orthopaedics. 12th edition Vol 1. Elsevier 2013: 2561-2612.
4. Nayak C, Acharya B, Jain M, Kambhoj K. Valgus osteotomy in delayed presentation of femoral neck fractures using fixed angle simple dynamic hip screw and plate. Chinese Journal of Traumatology 2019; 22: 29-33.
5. Judet R. Treatment of fractures of the femur neck by pedicled graft. Acta Orthop Scand 1962;32:421-7
6. Magu NK, Rohilla R, Singh R, Tater R. Modified Pauwels' Intertrochanteric Osteotomy in Neglected Femoral Neck Fracture. Clin Orthop Relat Res. 2009; 467:1064–1073.
7. Robins RHC. McMurray Osteotomy with a note on the 'regeneration' of articular cartilage. The journal of bone and joint surgery. 1960 August; 42-B(3): 480 – 488.
8. Marti RK, Schuller HM, Raaymakers ELFB. Intertrochanteric osteotomy for non-union of femoral neck. The journal of bone and joint surgery. 1989 November; 71-B(5): 782-787.
9. Raaymakers, et al.: Nonunion of femoral neck fracture. IJO. 2008; 42(1): 13-21.
10. Kakaria HL, Sharma AK, Sebastian B. Total Hip Replacement in avascular necrosis of femoral head. Medical Journal Armed forces. 2005 Jan; 61(1):33-35
11. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end result study using a new method of result evaluation. J Bone Joint Surg Am. 1969; 51: 737-55.
12. Roshan A, Ram S. The neglected femoral neck fracture in young adults: review of a challenging problem. Clin Med Res. 2008;6(1):33-39. doi:10.3121/cmr.2008.752
13. Schwartzmann CR, Spinelli LF, Yépez AK, Boschini LC, Silva MF. Femoral neck non-union treatment by valgus intertrochanteric osteotomy. Acta Ortop Bras. [online].2015;23(6):319-22. Available from URL: <http://www.scielo.br/aob>.
14. Agrawal AC. Neglected fracture neck of femur: Our experience. J Orthop Dis Traumatol 2018;1:21-2.
15. Ueno R. Erfahrung mit der Pauwels-Osteotomie und ihre Weiterentwicklung in den letzten 20 Jahren [Experiences with the Pauwels osteotomy and its improvement in the last 20 years]. Z Orthop Ihre Grenzgeb. 1991 May-Jun; 129(3):217-24. German. doi: 10.1055/s-2008-1040186. PMID: 1833906.
16. Ballmer FT, Ballmer PM, Baumgaertel F, Ganz R, Mast JW. Pauwels osteotomy for nonunions of the femoral neck. Orthop Clin North Am. 1990 Oct; 21(4):759-67. PMID: 2216406.
17. Gavaskar and Chowdary. Valgus sliding subtrochanteric osteotomy for neglected fractures of the proximal femur; surgical technique and a retrospective case series Journal of Orthopaedic Surgery and Research 2013, 8:4 <http://www.josr-online.com/content/8/1/4>
18. Tian S MDa, Liu M MMb, Zhang J, Zhang L MMa et al. Intertrochanteric valgus osteotomy for post-traumatic coxa vara after proximal femur fractures. Medicine. November 12, 2021; 100(45):26829. doi: 10.1097/MD.00000000000026829
19. Kumar N, Kalra M. Evaluation of valgus intertrochanteric osteotomy in neglected fracture neck femur in young adults. Journal of Clinical orthopedics and Trauma. 2013; 4: 53-57.
20. Mueller ME. The intertrochanteric osteotomy and pseudarthrosis of the femoral neck. Clin Orthop. 1999;363:5e8.

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