Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i8.7346

CORRELATION OF MODIFIED FEMORAL NECK SHAFT ANGLE WITH AGE AND GENDER

Priyanka Yadav[1] , Dr Muktyaz Hussein[2] , Namrata Singh[3], Rajkumar[4*]

[1](Tutor) -Department of Anatomy, Government Medical College, Budaun U.P, India
[2](Associate Professor) -Department of Anatomy, Government Medical College, Budaun, U.P, India
[3] (Tutor)-Department of Anatomy, Autonomous State Medical College, Kanpur Dehat, U.P, India.
[4*] (Tutor)-Department of Anatomy, Ganesh Shankar Vidyarthi Memorial Medical College, Kanpur, U.P, Email id- rajkumarjackson1991@gmail.com

***Corresponding Author:** Rajkumar (Tutor)
*Department of Anatomy, Ganesh Shankar Vidyarthi Memorial Medical College, Kanpur, U.P
Email id- rajkumarjackson1991@gmail.com

ABSTRACT

Introduction: The modified femoral neck shaft angle is defined as the angle between femoral shaft axis and modified femoral neck axis. Line drawn from upper most extension of greater trochanter, crossing the centre of two circles that is upper circle is positioned at the outer margins of the sub-trochanteric femur, the centre of this circle is placed by the lower boundary of the lesser trochanter whereas, the lower one is placed above the end of the scan. The objective of the our study is to determine the bilateral inconsistency in the mean value of modified femoral neck shaft angle.

Materials and Methods: The study group was comprised of 100 CT images (54 Females and 46 males) of pelvis in scout view of patient. All the measurements were done using CT images with the help of Simens 128 slice CT machine and software syngo CT VA48A.

Result-Comparison of right and left modified NSA by sex as following the value of mean and Standard deviation for mNSA in right side of female were found 145.72^0 (8.39) and right side of male were found 147.63° (6.74). p value for right side in both genders were 0.283.The value of mean and Standard deviation for mNSA in left side of female were found 145.13° (8.75) and left side of male were found 146.39° (6.35). p value for left side in both genders were 0.407.

Conclusion: In male, the modified neck shaft angle of femur is more as compared to female in any age group.

Keywords- Femoral shaft axis, modified femoral neck axis, modified Femoral neck shaft angle.

INTRODUCTION

The Femur is the longest and strongest bone of the human body. Morphologically, it is a typical long bone and it forms skeleton of the thigh so it is called “thigh bone”. The modified femoral neck shaft angle is defined as the angle between femoral shaft axis and modified femoral neck axis. (1) The femur has a single major center that appears for the shaft during the eighth week of intrauterine life, and the upper end has three secondary centers that appear for the head in the first year, for the greater trochanter in the third year, and for the smaller trochanter in the thirteenth year. (2) The femoral neck is roughly 5 cm long and connects the head to the shaft at an average angle of 135°. this angle allows for movement at the hip joint, allowing the limb to swing clear of the pelvis. (3)

The femoral neck-shaft angle, commonly known as the caputcollum-diaphyseal (CCD) angle, is an inclination angle. Mikulicz angle is a measurement of the angle formed by the obliquely oriented neck and the vertical shaft, and it is an important anatomic measurement for evaluating hip biomechanics. (4)
The modified neck- shaft angle (mNSA), unlike the standard NSA, is rarely affected by rotation. (5) The femoral neck shaft angle has significant implications in orthopedic surgery. A displaced femoral neck fracture frequently results in a change in the femoral neck shaft angle. Diagnosis of congenital hip disorders such as developmental dysplasia of the hip [DDH], CoxaVara and Valga, and developmental problems such as slipped upper femoral epiphysis are also considered femoral neck shaft angle.(6) The diagnosis and treatment of proximal end femoral fracture are dependent on an understanding of the angle of inclination. The bone markers like the upper end of the femur, such as the head and neck of the femur, play a significant influence in determining femoral length. As a result, femoral length and stature are anthropological and forensically important. (7) Females have a smaller neck-shaft angle, which connects their larger pelvis and shorter femur length, however some research show females have higher values. (8) The neck shaft angle is generally around 160° in a young kid and about 125° in an adult (coxa Norma).
An increase in this angle is known as coxaValga (>140°), and it can occur in the event of congenital hip dislocation. Adduction of the hip joint is limited in this situation. A decrease in this angle is known as coxaVara (120°), and it occurs in fractures of the femoral neck and slippage of the femoral epiphysis. Abduction of the hip joint is limited in this situation. (9) The purpose of this study is to calculate the modified femoral neck shaft angle. The modified NSA (mNSA) is less susceptible to rotational effects than the traditional NSA. The Modified neck shaft angle is crucial in the anatomic description of the hip for diagnostics and surgery planning. (10) The femoral neck is the most commonly fractured region of the bone because it is the narrowest and weakest part of the bone and lies at a sharp angle to the line of weight-bearing (gravity pull). It becomes increasingly fragile with age, especially in females, as a result of osteoporosis. (11) CT scot pictures are a safer alternative to traditional CT scans since they reduce radiation exposure and can detect pathological changes in situations such as fractures, metastases, and avascular necrosis, as well as determine lower limb alignment and geometry. (12)

MATERIALS AND METHODS

This is cross sectional study and it was conducted in the Department of Anatomy in the collaboration with Department of Radiodiagnosis at IIMS&R Integral University, Lucknow Uttar Pradesh. The study group was comprised of 100 CT images (54 Females and 46 males) of pelvis in scout view of patient above the age of 18 years.

Inclusion and Exclusion criteria

Upper end of femur is visible the inclusion criteria and Pathology of hip joint, History of surgery around hip joint are the exclusion criteria.

Measurements:

Femoral shaft axis (FSA)- Line drawn from upper most extension of greater trochanter, crossing the centre of two circles that is upper circle is positioned at the outer margins of the sub-trochanteric femur, the centre of this circle is placed by the lower boundary of the lesser trochanter whereas, the lower one is placed above the end of the scan. (Fig.1)

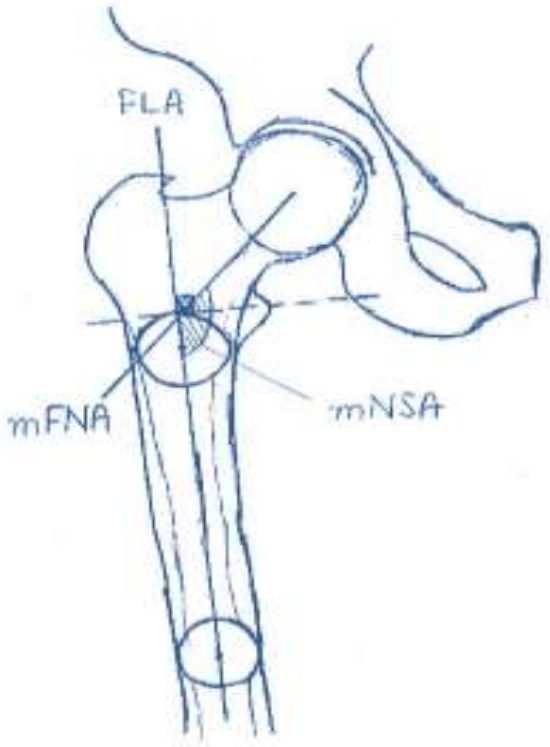

Figure 1. The modified neck shaft angle, femoral shaft axis, modified femoral neck axis of femur.

The modified femoral neck axis (mFNA)-The modified femoral neck axis is a line connecting the center of femoral head and center of rotation. It is an intersecting point between FSA and horizontal line (at the apex of lesser trochanter to the FSA). Thus, Modified Femoral NSA (mNSA) is defined as the angle between the FSA and the modified FNA (mFNA). (Fig.2)

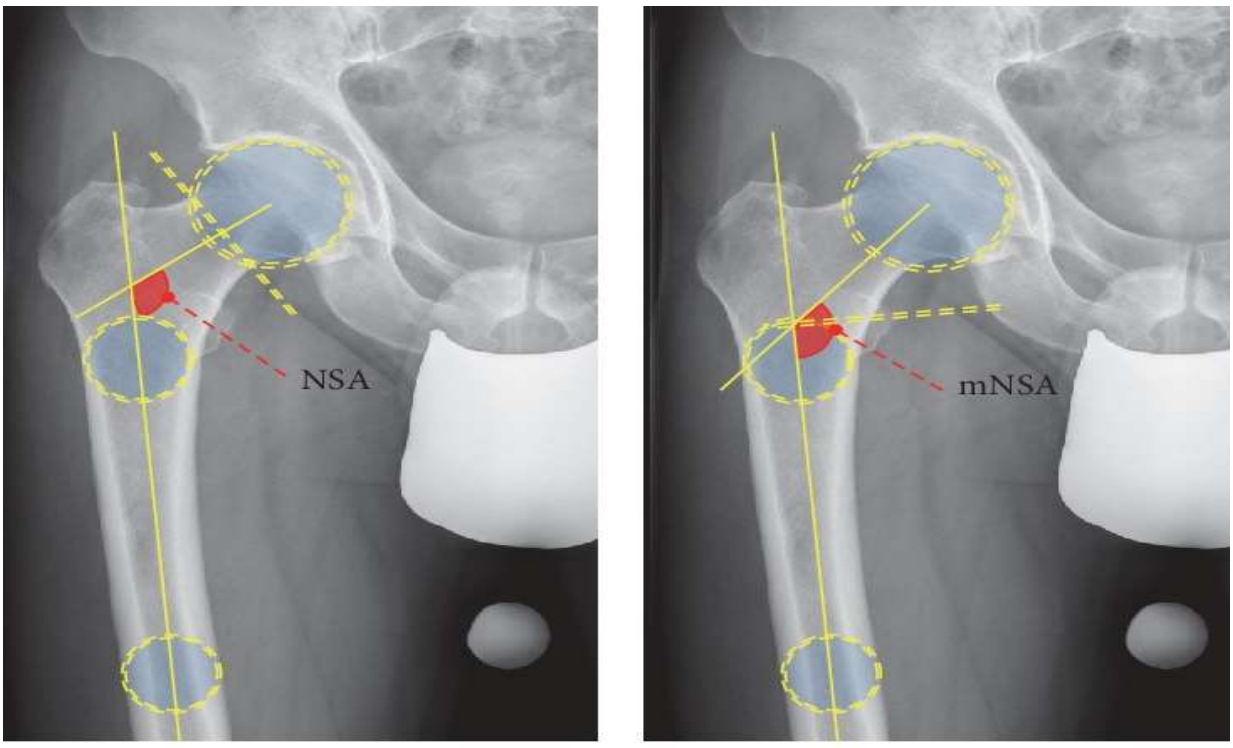

Figure 2. (a) Normal neck shaft angle, CT image (b) The modified NSA of femur, CT image

RESULTS & OBSERVATION

Mean value of both gender were found to be 43.77 years and with the standard deviation 16.63, between 54(54.0) percent of female and 46(46.0) percent of male. The mean value of Right modified NSA was found to be 146.60° with Std. deviation 7.70. and mean value of left modified NSA were found to be 145.71° with S.td deviation 7.73. The differences of the modified NSA between right and left were less statistically significant. (Table-1)

Table 1: Description of variables

Age	Mean = 43.77 years Std. Deviation = 16.63
Sex	Female N (%) = 54 (54.0) Male N (%) = 46 (46.0)
Right Modified NSA	Mean = 146.60° Std. Deviation = 7.70
Left Modified NSA	Mean = 145.71° Std. Deviation = 7.73

The KS test of right modified NSA were found 0.096* and p value 0.023. In female the KS test for right side were found 0.095 in which p value 0.200 and KS test of male for right side were found 0.148* in which p value o.013.The KS test of left modified NSA were found 0.082 and p value 0.093. the KS test in female of left side were found o.094 in which p value 0.200 and the KS test of male in left side were found 0.106 in which p value 0.200 the KS test for age were found 0.130* with p value 0.000. the KS test were not statistically significant (p value=0.000) in age group for both gender. The KS test for right mNSA (p value=0.23) and left mNSA (p value=0.093) were less statistically significant. (Table-2)

Table 2: Test of Normality for age, sex, right, and left modified NSA

Variables	**Kolmogorov-Smirnov statistic**	**p-value**
Right Modified NSA	0.096*	0.023
Female	0.095	0.200
Male	0.148*	0.013
Left Modified NSA	0.082	0.093
Female	0.094	0.200
Male	0.106	0.200
Age	0.130*	0.000

Comparison of right and left modified NSA by sex as following the value of mean and Std deviation for mNSA in right side of female were found 145.72^0(8.39) and right side of male were found 147.63° (6.74). p value for right side in both gender were 0.283. The value of mean and Std. deviation for mNSA in left side of female were found 145.13° (8.75) and left side of male were found 146.39° (6.35). p value for left side in both gender were 0.407. Hence, the modified NSA is very less significantly distributed across sex. (Table-3)

Table 3: Comparison of right and left modified NSA by sex

Modified NSA	**Sex**		**p-value**
	Female **Mean (SD)**	**Male** **Mean (SD)**	
Right	145.72° (8.39)	147.63° (6.74)	0.283
Left	145.13° (8.75)	146.39° (6.35)	0.407

Comparison of right and left modified NSA by sex as following the value of mean and Std deviation for mNSA in right side of female were found 145.72^0(8.39) and right side of male were found 147.63° (6.74). p value for right side in both gender were 0.283. The value of mean and Std. deviation for mNSA in left side of female were found 145.13° (8.75) and left side of male were found 146.39° (6.35). p value for left side in both gender were 0.407. Hence, the modified NSA is very less significantly distributed across sex. (Table-3)

Correlation between age, right mNSA, and left mNSA as following the right mNSA were found (coefficient = 0.235, $p < 0.05$) and left mNSA (coefficient = 0.217, $p < 0.05$). The results of Table 4 can be interpreted as age is positively but weakly correlated with both the right modified NSA and left modified NSA.

Table 4: Correlation between age, right modified NSA; and left modified NSA

Modified NSA	Age	p-value
Right	0.235*	0.018
Left	0.217*	0.030

Correlation between age, right mNSA, and left mNSA as following the right mNSA were found (coefficient = 0.235, $p < 0.05$) and left mNSA (coefficient = 0.217, $p < 0.05$). The results of Table 4 can be interpreted as age is positively but weakly correlated with both the right modified NSA and left modified NSA.

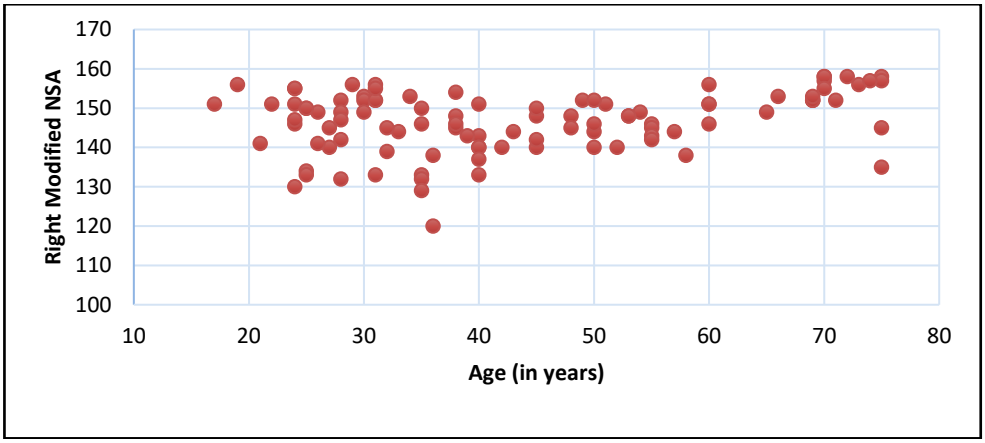

Figure 3. Scattered plot of Right modified neck shaft angle by age.

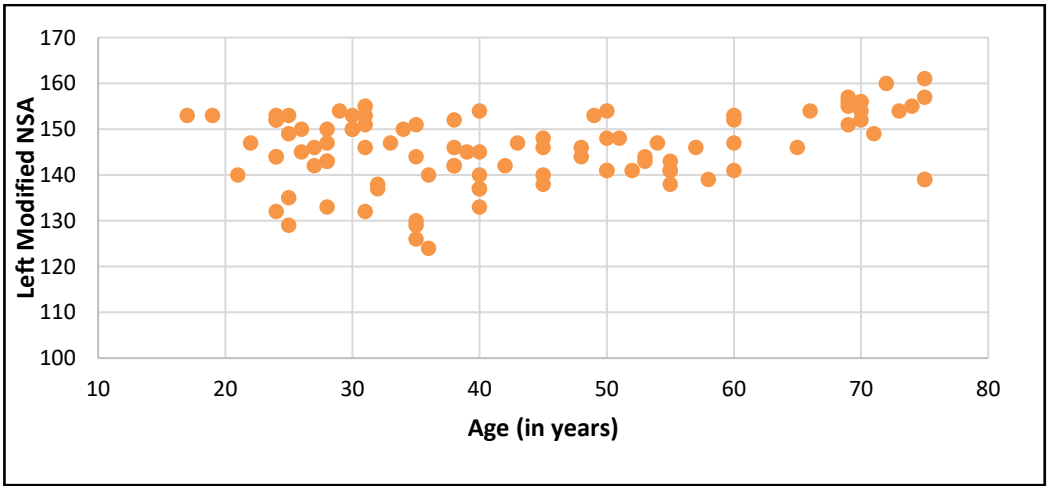

Figure 4. Scattered plot of Left modified neck shaft angle by age.

DISCUSSION

In this study, the mean age of all 100 patients was 43.77 years (above 18, SD 16.63 years) whereas in 2016 study conducted by Boese CK et. al. described mean age of all 400 patients was 54.32 years (18-100, SD 22.05 years). The mean modified NSA on right side was 146.60° and on left side was 145.71°. while R Amith et. al. (2017) observed mean value of NSA, 120.9° in right side and 121.5° in left side. Whereas AC Odenton Thomas et. al. (2022) measured the mean value NSA of on the right side was 130.66° and the mean value on left side was 129.40°. However Fischer S Cornelius et. al. (2020) obtained mean value of NSA on right and left side was 127°. While Zaghloul Ahmed et. al. (2020) observed the mean value of NSA on right side was 133.04° and the mean value of left side was 133.42°. Whereas A Shivashankar Appa et. al. (2017) obtained the mean value of NSA on right side was 136.2° and mean value of NSA on left side was 140.1°. The P value of right modified NSA in male and female was (P=0.283). and the P value of left modified NSA in male and female was (P=0.407). while Lyidobi C. Emmanuel et. al. (2020) measured the P value of right and left was (P=0.62). Whereas R Amith et. al. (2017) observed the P value right and left was (P=0.87).

CONCLUSION

In males, the modified neck shaft angle of femur is more as compared to females in any age group. The difference of the modified neck shaft angle of femur between right and left side is very less that is very less statistically significant.

REFERENCES

1. Huda Najamul, Agarawal Ankur, Sharma Mohan Man, Agarwal Saurabh. Age and gender differences in modified femoral neck-shaft angle: an MRI based observational study, Feb-(2020)p2277-8179.
2. Faruqi N.A a clinical orientation human osteology. 3rd edition 2018:58-76
3. Gujar S, Vikani S, Parmar J, Bondre KV. A correlation between femoral neck shaft angle to femoral neck length. Int J Biomed Adv Res.2013;4:295-7.
4. Wright D, Whyne C, Hardisty M, Kreder HJ, Lubovsky O. Functional and anatomic orientation of the femoral head. ClinOrthopRelat Res. 2011 Sep;469(9):2583-9.
5. Boese CK, Frink M, Jostmeier J, Haneder S, Dargel J, Eysel P, et al. The modifed femoral neck-shaft angle: age-and sex-dependent reference values and reliability analysis. Biomed Res Int. 2016; 2016: 8645027.
6. Panula J. Surgically treated hip fracture in older people With Special Emphasis on Mortality Analysis, University of Turku, Turku, Finland [online]; 2010.
7. Khan SM, Saheb SH. Study on neck shaft angle and femoral length of south Indian femurs. Int J Anat Res. 2014;2(4):633-35.
8. Sharma V, Kumar K, Kalia V, Soni P. Evaluation of femoral neck-shaft angle in sub Himalayan population of North West India using digital radiography and dry bone measurements. Journal of the Scientific Society. 2018;45(1):3-7.
9. Snell Richard S. clinical anatomy by regions. 8th edition 2006:561.
10. Boese CK, Frink M, Jostmeier J, Haneder S, Dargel J, Eysel P, Lechler P. The Modified Femoral Neck-Shaft Angle: Age- and Sex-Dependent Reference Ethics and Reliability Analysis. Biomed Res Int. 2016;2016:8645027. doi: 10.1155/2016/8645027. Epub 2016 Dec 14. PMID: 28070521; PMCID: PMC5192320.
11. Moore Keith L, Dalley Arthur F, Agur Anne M.R clinically oriented anatomy. 6th edition 2009:525.
12. Burghardt RD, Hinterwimmer S, Bürklein D, Baumgart R. Lower limb alignment in the frontal plane: analysis from long standing radiographs and computer tomography scout views: an experimental study. Arch Orthop Trauma Surg. 2013 Jan;133(1):29-36. doi: 10.1007/s00402-012-1635-z. Epub 2012 Oct 30. PMID: 23109093.