MORPHOMETRIC CHARACTERISTIC OF PROXIMAL FEMUR INHAJI ADAM MALIK GENERAL HOSPITAL 2017 – 2022

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Abstract

In the United States, cases of proximal femur fracture are more than 250.000 – 300.000 cases per year and mortality rates range from 14% - 36%. Although cases of proximal femur fracture are more common in American and European population, Asian continent also has a considerable number of cases. Morphometry is a combine study for geometry and biology which related with three dimensional structur specially in human organ. Implant / prostheses that are produced sometimes do not match the morphometry because that are produced according to the population of Western countries and Caucasian population because of lack of morphometric data for Asian especially Indonesian population. This descriptive observational research used the total sampling method with subjects 20 – 70 years old subjects who underwent Pelvic X-Ray in Adam Malik Hospital. The proximal femur parameter consists of femoral head diameter, femoral neck diameter, femoral neck length, and femoral neck shaft angle. The result from measuring proximal femur morphometry of 120 subjects and Kappa test was used to analyze the measurements between two examiners. Femoral head diameter has a mean of 48.01 ± 4.24, femoral neck diameter is 33.88 ± 3.43, femoral neck length is 21.26 ± 3.16. and femoral neck shaft angle is 131.7 ± 3.53.

Keywords: morphometry, proximal femur, femoral head diameter, femoral neck length, femoral neck diameter, femoral neck shaft angle

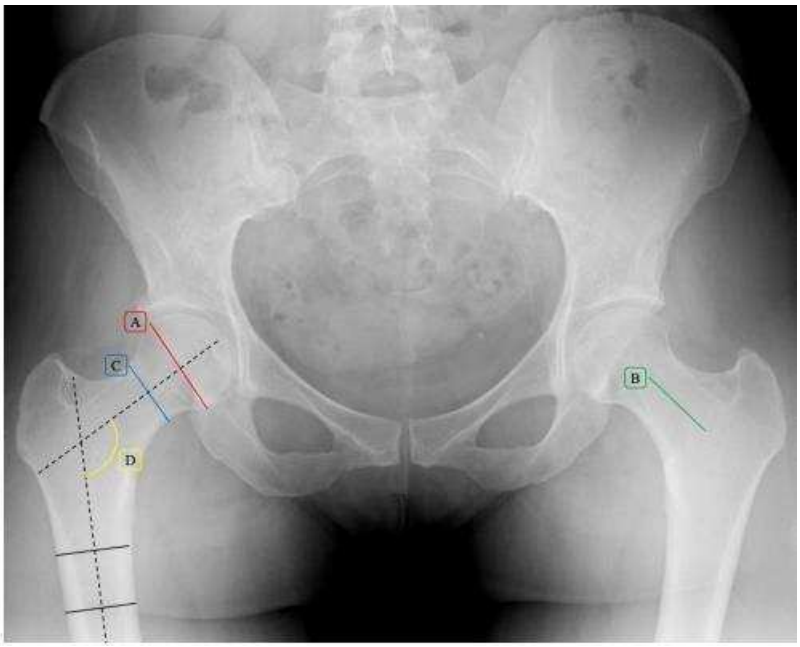
Introduction

Operative treatment of proximal femur is one of the most frequent due to the high incident of proximal femur fracture. The purpose of this operative treatment is to excise pathological tissue dan restore anatomical structure. Up until now, either proximal femur or hip replacement implants are produced based on Western country's proximal femur morphometry. This result in the frequently incompatible implants/ prosthesis with eastern patient populations. Morphometric parameter is important for implant/ prosthesis design especially for cementless prosthesis. Proximal femur morphometric has an important role in the incidence of proximal femur fracture which consist of several parameter such as hip axis length (HAL), femoral neck axis length (FNAL), femoral head width, and femoral neck shaft angle (FNSA), those parameters are related to mechanical strength of proximal femur. (Nayak, Baisakh and Chinara, 2018). In reference to Riskesdas, the most frequently injured human body sorted from highest to lowest order are lower extremity 67%, upper extremity 32%, head injury 11,9%, back injury 6,5%, chest injury 2,6%, and abdominal injury 2,2%. (Ridwan, UN., Pattiiha, AM., Selomo, 2018). Frequently used implant for proximal femur fracture or other pathological anomaly treatment are diynamic hp screws, proximal femur nailing, cannulated cancellous screws, and bipolar / total replacement prosthesis. (Blom, Warwick and Whitehouse, 2018; Jogani, Rathod

and Shende, 2019). This research is conducted in hope for better treatment choice in proximal femur disorder especially for North Sumatra populations.

Methods

This report is the result of descriptive observational research which data were collected from case series that describe the morphometric characteristic of proximal femur of North Sumatera populations. The samples are 20-70 years old subjects who underwent pelvic radiological exam (X Ray). The data were collected by total sampling method from December 2017 to December 2022 and were analyzed by Kappa Statistical method to test the inter-rater reliability between the two examiners.



Picture 14. Pelvic X-ray AP view
(a)Femoral Head Diameter (FHD)
(b)Femoral Neck Length (FNL)
(c)Femoral Neck Diameter (FND),
(d)Femoral Neck Shaft Angle (FNSA)

Result

This research of 5 years data of a total 150 patients results is as follows.

a. Patient characteristics

Sex	Amount (%)
Male	63 (52,5)
Female	57 (47,5)

There was more male respondent (52,5%) compared to female (47,5%)

b. Proximal Femur Morphometry

Morphometry	Total Sample (n=120)	Male (n=63)	Female (n=57)
Femoral Head Diameter	48.01 ± 4.24	50.50 ± 3.50	45.27 ± 3.18

Femoral Neck Diameter	33.88 ± 3.43	35.17 ± 3.44	32.44 ± 2.81
Femoral Neck Length	21.26 ± 3.16	22.05 ± 3.13	20.39 ± 2.99
Femoral Neck Shaft Angle	131.7 ± 3.53	131.4 ± 3.17	131.9 ± 3.90

The table above shows the result from measuring proximal femur morphometry of 120 patients. Femoral head diameter has a mean of 48.01 ± 4.24, with the mean of male respondent n=63) 50.50 ± 3.50, and female (n=57) 45.27 ± 3.18. The mean measurement of femoral neck diameter is 33.88 ± 3.43 with male mean measurement 35.17 ± 3.44, and female mean measurement is 32.44 ± 2.81. For femoral neck length this research result in 21.26 ± 3.16, with male's mean 22.05 ± 3.13, and female's mean 20.39 ± 2.99. Lastly, for femoral neck shaft angle, we reported mean measurement of 131.7 ± 3.53, with male mean measurement of 131.4 ± 3.17, with female mean measurement of 131.9 ± 3.90.

These results were then analysed with Kappa Statistic, the result is presented in the following table.

Kappa Test	Value	p value
Femoral Head Diameter	0,941	< 0,001
Femoral Neck Diameter	0,856	< 0,001
Femoral Neck Length	0,958	< 0,001
Femoral Neck Shaft Angle	0,803	< 0,001

Statistical analysis shows that Kappa values are >0,8. This means that the result is in excellent agreement in terms of reliability. Results of p value also shows that the result is significant.

Discussion

The result in our case report shows that there are differences between the measurement of male and female respondents. Male respondents have larger morphometry measurements in terms of Femoral Head Diameter, Femoral Neck Diameter and Femoral Neck Length although there was no significant difference in the morphometry measurement of Femoral Neck Shaft Angle.

These results can be compared with other countries' results. Croatian has the smallest mean of Femoral Head Diameter which 38.84 ± 5.32 mm while the largest mean measurement is from Turkey with 48.1 ± 3.7 mm. For Femoral Neck Diameter Hongkong showed the smallest mean measurement of 31 mm and the largest is measured from Denmark with 35.5 ± 3 mm. It is reported that Kenya has the smallest mean measurement o Femoral Neck Length with 29,36 mm while the biggest is from Croatia with 44.29 ± 4.31 mm. For Femoral Neck Shaft, India has the smallest mean measurement which is 118.52 ± 8.9 while the biggest mean is 135 from Hongkong.

	FHD (mm)	**FNL (mm)**	**FND (mm)**	**FNSA (Angle)**
India(P and K. R., 2019)	42,43 ± 4,2	32,16 ± 5,9	30,65 ± 3,9	$118,52^0$ ±$8,9^0$

Denmark(Nissen et al., 2005)	48 ± 2,5	-	35,5 ± 3	$130^0 \pm 5^0$
Turki(Iyem et al., 2014)	48,1 ± 3,7	30,8 ± 6,1	35,4 ± 4,2	$130,4^0 \pm 5,1^0$
Nepal(Mukhia et al., 2019)	41,53 ± 2,8	41,2 ± 3,2	29,4 ± 3	$127,1^0 \pm 6,4^0$
Brazil(Branco de Sousa et al., 2010)	47,1	30,1	31,1	$132,1^0$
Kenya(Lakati et al., 2017)	42,6	29,36	-	$129,21^0$
Negara Barat(Siwach, 2018)	46,1	-	-	$124,7^0$
Ras Kaukasia(Siwach, 2018)	46	-	33	136^0
Hongkong(Siwach, 2018)	45	-	31	135^0
Kroasia(Mokrovic et al., 2021)	38,84 ± 5,32	44,29 ± 4,31		$125,34^0 \pm 4,26^0$
Jepang(Nakanishi et al., 2018)	-	-	-	$126,5^0$
RSUP Haji Adam Malik	48.01 ± 4.24	21.26 ± 3.16	33.88 ± 3.43	131.7 ± 3.53^0

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