Second hip fracture in osteoporotic patients and its risk factors in Al-Ahsa, Saudi Arabia: A case-control study

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ABSTRACT

Background: Osteoporosis is a systemic disorder characterized by microarchitectural deterioration of bone and decreased bone mass with increased bone fragility resulting in increased susceptibility to fracture. The fracture caused by bone's fragility is a common pathology among old subjects and the frequency rises within the increase of the average age of the population. Hip fractures are

the main cause of hospitalization in elderly patients in industrialized countries. *Methods*: A case control study that was conducted in the king Fahd hospital in Al-hufof over three months interval, by using patients file data including 95 participants of osteoporotic patients with previous hip fracture. *Results*: High BMI (>20 Kg/m2), history of having fractures with osteoporosis, and rheumatoid arthritis were the most important risk factors for second fracture among study patients. While family history and early menarche or late menopauses were insignificantly associated with second fracture history. Nicotine abuse recorded 70% more risk to have second fracture among osteoporotic patients with no statistical significance. Patients with anorexia nervosa had a significant tripled risk for second fracture compared to others without. *Conclusion*: Osteoporotic patients with first hip fracture are highly liable to get the second hip fracture. We highly suggest that the ministry of health to implement an effective guidelines in terms of following the elderly patient with first hip fracture.

Keywords: Osteoporosis, Second hip fracture, Risk factors.

1. INTRODUCTION

Osteoporosis may be a systemic disorder characterized by microarchitectural deterioration of bone and decreased bone mass with increased bone fragility leading to increased susceptibility to fracture. One in 4 women and 1 in 8 men over the age of fifty years has osteoporosis. This prevalence rises with age, especially after the age of 80 years. The lifetime prevalence of hip fracture in women is eighteen and in men is 6%. Estimates indicate that the annual number of osteoporotic hip fractures world- wide will increase from 1.66 million to six. 26 million by the year 2050, and in Canada is predicted to succeed in over 88 000 annually by the year 2041 (Juby & De Geus-Wenceslau, 2002). The results showed that 82% of Saudi women patients had viosterol deficiency. Only 21% of girls were exposed to sunlight. 58% of the ladies had low BMD (18% with osteoporosis and 40% with osteopenia). Only 5% of patients took D and Calcium rich diet and seven were within the habit of doing exercise. There was a big association between bone mass density and exercise when Fisher's exact test was used (P value < 0.05) (Oommen & AlZahrani, 2014). The fracture caused by bone's fragility may be a common pathology among old subjects and therefore the frequency rises within the rise of the typical age of the population. The vertebral soma, the proximal humerus, the femur and also the distal radium are more frequent to fracture in elderly patients causing morbidity and hospitalization (Rasi et al. 2020). Hip fractures, both neck fracture and intertrochanteric (or subtrochanteric), are the most causes of hospitalization in elderly patients in industrialized countries (Lê & Nguyen, 2020). These styles of fractures are causing a rise of mortality, of morbidity and loss of independence. Direct causes of fractures are represented by falls of subjects in advanced age where traumas are caused by a loss of energy. Indirect causes are represented by falls caused by health conditions for instance dementia, but also other neurological diseases, just like the Parkinson's disease, COPD and in smaller percentage sight problems and vertigos. Age, the female sex, alcoholism, living by themselves and former fractures are useful factors so as to cut back hip fractures. A previous fragility fracture can represent an extra risk which mostly verifies within a year after the primary fracture. After the primary fracture, the trabecular architecture of the proximal femur changes with a decrease of the Singh index caused by the immobility. Over 80 years old and a significant state of immobility increase the chance of second fracture, load lack on the skeleton increases the mobilization of calcium on bones and negatively influences on the muscular tone increasing the chance of fall and also the probability of fracture risks Scaglione & Fabbri, 2013). The annual cost of management of osteoporosis-related proximal femoral fractures within the eastern province of Saudi Arabia is US$12.78 million. Because the Arab population is aging and also the number of elderly patients is sure to increase with an accompanying increase in fractures (Bubshait & Sadat-Ali, 2007), during this study the authors will study the danger of second hip fracture after primary fracture in osteoporosis patients.

2. PATIENTS AND METHODS

Study design and population

During the time from June 2020 to September 2020, a case control study was conducted in the AlAhsa region of Saudi Arabia. A total of 92 patients were enrolled in this study. Participants were elderly men and women aged 65-100 years who experienced a hip fracture due to low-energy trauma. Young patients, high energy trauma and pathological fractures were excluded from the study. Patients with second hip fractures were in the case group as in Figure 1, to be compared with control group who having the first hip fractures (Figure 2).

Data collection

Hip fractures were identified by radiographs imaging. Then, Patients demographics were as follows: age, gender, weight, height, time of first and second hip fractures has been collected from patient's medical records using the hospital system. Assessments of

risk factors were done by using a standardized questionnaire of German society of osteology. We have contacted the patients and their family members through a telephone call. Verbal consent was obtained from the patients to be part of the study. The following risk factors has been asked to the case and control group : reduction of body height >4cm, alcohol abuse, smoking, age >70, anorexia nervosa, anticonvulsive therapy , already suffered osteoporotic fractures, BMI <20 kg/m2, chronic renal or hepatic disease, family history, early menopause <45 years , late menopause >15 years , high dose heparin therapy, hormone replacement therapy, hyperparathyroidism, hyperthyroidism, diabetes mellitus, immobilization, malabsorption syndrome, multiple sclerosis, smoking and rheumatoid arthritis.

Figure 1 First hip fracture in control group

Figure 2 second hip fractures in case group

Statistical analysis

After data were extracted, it was revised, coded, and fed to statistical software IBM SPSS version 22 (SPSS, Inc. Chicago, IL). All statistical analysis was done using two tailed tests. P value less than 0.05 was statistically significant. Descriptive analysis based on frequency and percent distribution was done for all variables of study cases and controls including patient's personal data including age and gender. Cross tabluation was used to assess distribution of different risk factors of second hip fracture among study cases and controls. Significance of relations in cross tabulation was tested using Pearson chi-square test.

3. RESULTS

The study included 92 osteoporotic patients (46 were cases and 46 as controls). Exact of 76.1% of the cases aged above 70 years compared to 73.9% of the controls with no statiscal significance (P=.810). As for gender, 60.9% of the cases were females compared to 56.5% of the controls with no significant difference (P=.672) (table 1).

Table 1 personal characteristic of study cases and controls

Personal data	Group				P-value
	Case		Control		
	No	%	No	%	
Age in years					
< 70 Yrs.	11	23.9%	12	26.1%	.810
> 70 Yrs.	35	76.1%	34	73.9%	
Gender					
Male	18	39.1%	20	43.5%	.672
Female	28	60.9%	26	56.5%	

P: Pearson X^2 test

Table 2, Chart 1 A, B, C and D illustrates risk factors of second hip fracture in osteoporotic patients. As for personal related factors, patients with BMI above 20 Kg/M2 had nearly five folds more likelihood to have second fractures compared to others with lower BMI with recorded statiscal significance (OR=4.7; 95% CI: 1.7-13.1). Family history and early menarche or late menopause were insignificantly associated with second fracture history (P>0.05). Regarding lifestyle related factors, immobilization was insignificantly associated with 1.5 folds for being cases rather than being controls. Also, nicotine abuse recorded 70% more risk to have second fracture among osteoporotic patients with no statiscal significance. Regarding co-morbidities, patients with anorexia nervosa had a significant tripled risk for second fracture compared to other without (OR=2.8; 95% CI: 1.2-6.8). Also, osteoporotic patients who suffered from past fractures recorded 7 times likelihood for having second fracture than those who did not (OR=6.9; 95% CI: 1.4-33.3). Rheumatoid arthritis increased the risk for second fractures among osteoporotic patients by about 7 folds (OR=6.9; 95% CI: 1.8-22.6). All other disorders including renal disorders, hyperparathyroidism, DM, and multiple sclerosis were insignificantly associated with higher risk for second fracture except for hyperthyroidism and mal-absorption syndrome were insignificantly protective. As for drug related factors, none of the studied drugs showed significant relation with second fractures among osteoporotic patients.

Table 2 Risk factors of second hip fracture in osteoporotic patients

Category	Risk factors	Group				OR (95% CI)
		Case		Control		
		No	%	No	%	
Personal factors	Family history	4	8.7%	3	6.5%	1.4 (0.3-6.5)
	Early menopause (< 45 Yrs..)	3	6.5%	2	4.3%	1.5 (0.2-9.6)
	Late menarche (> 15 yrs.)	0	0.0%	0	0.0%	-
	BMI < 20 kg/m2	19	41.3%	6	13.0%	4.7 (1.7-13.3) *
Lifestyle related factors	Immobilization, Inactivity	22	47.8%	18	39.1%	1.4 (0.6-3.3)
	Nicotine abuse	8	17.4%	5	10.9%	1.7 (0.5-5.7)
	Alcohol abuse	0	0.0%	0	0.0%	-
Co-morbidities	Anorexia nervosa	23	50.0%	12	26.1%	2.8 (1.2-6.8) *
	Already suffered osteoporotic fractures	44	95.7%	35	76.1%	6.9 (1.4-33.3) *
	Chronical renal or hepatic disease	9	19.6%	4	8.7%	2.6 (0.7-8.9)
	Hyperparathyroidism	2	4.3%	0	0.0%	1.8 (0.9-2.4)
	Hyperthyroidism	1	2.2%	2	4.3%	0.48 (0.1-5.6)
	diabetes mellitus	30	65.2%	30	65.2%	1.0 (0.5-2.4)
	Malabsorption-syndrome	1	2.2%	3	6.5%	0.32 (0.1-3.2)
	Multiple Sclerosis	1	2.2%	0	0.0%	1.3 (0.8-2.6)
	Rheumatoid Arthritis	15	32.6%	3	6.5%	6.9 (1.8-22.6) *
Drug related factors	Anticonvulsive therapy	7	15.2%	2	4.3%	3.9 (0.8-20.1)
	High dose heparin therapy	8	17.4%	4	8.7%	2.2 (0.7-7.9)
	Hormone replacement therapy	1	2.2%	0	0.0%	1.3 (0.8-2.6)

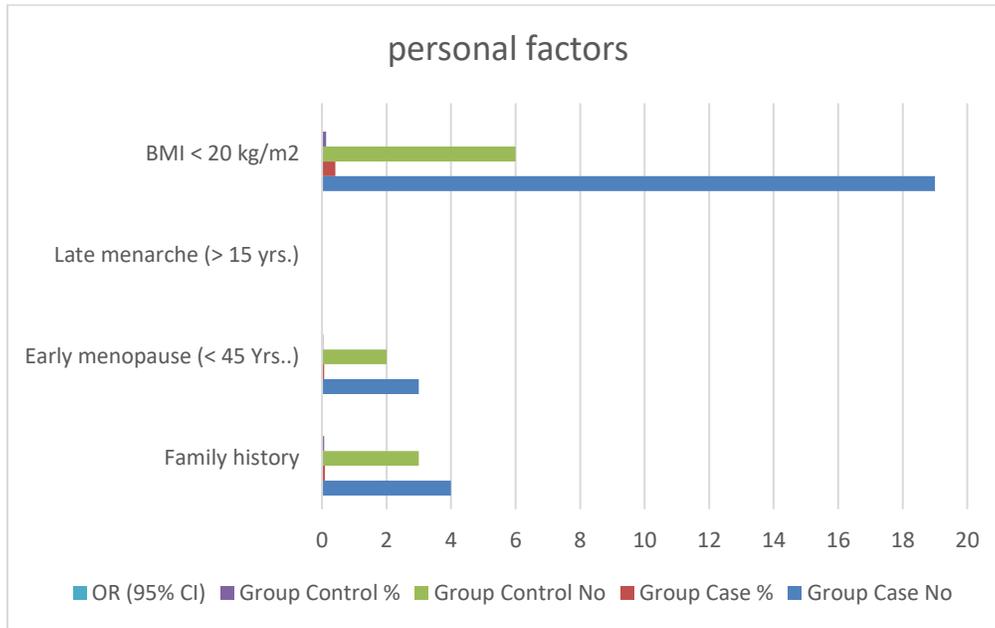OR: Odds ratio   CI: Confidence interval

* P < 0.05 (significant)

personal factors

Chart 1 A Personal factors of second hip fracture in osteoporotic patients

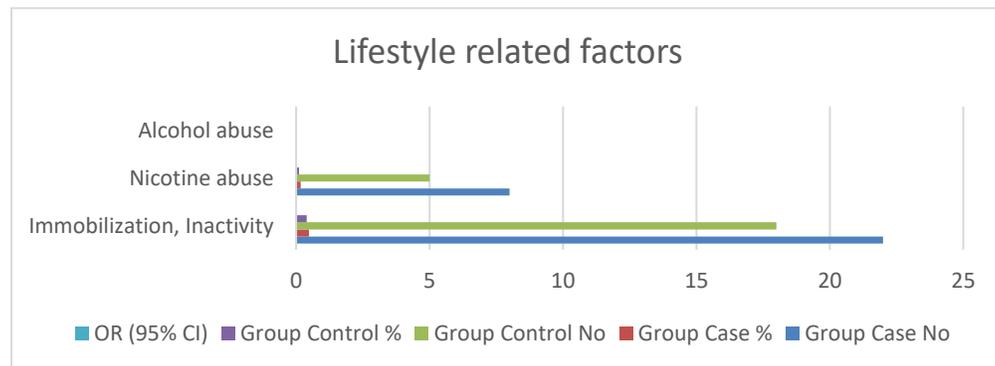## Lifestyle related factors

Chart 1 B Lifestyle related factors of second hip fractures in osteoprotic patients
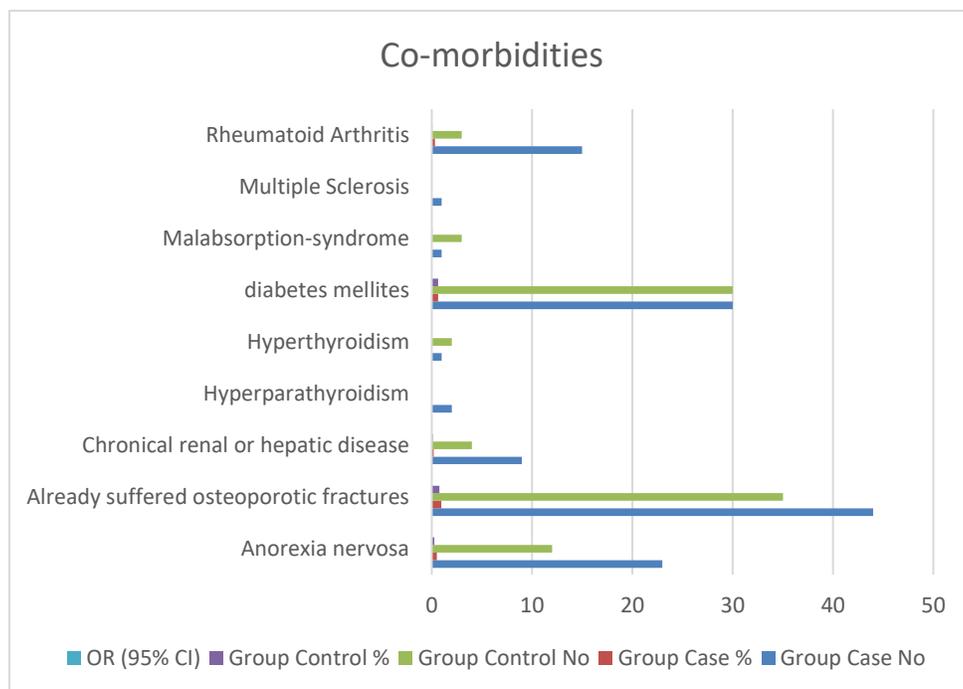
Co-morbidities

Chart 1C Co-morbidities factors of second hip fractures in osteoporotic patients

Drug related factors

Chart legend: OR (95% CI), Group Control %, Group Control No, Group Case %, Group Case No
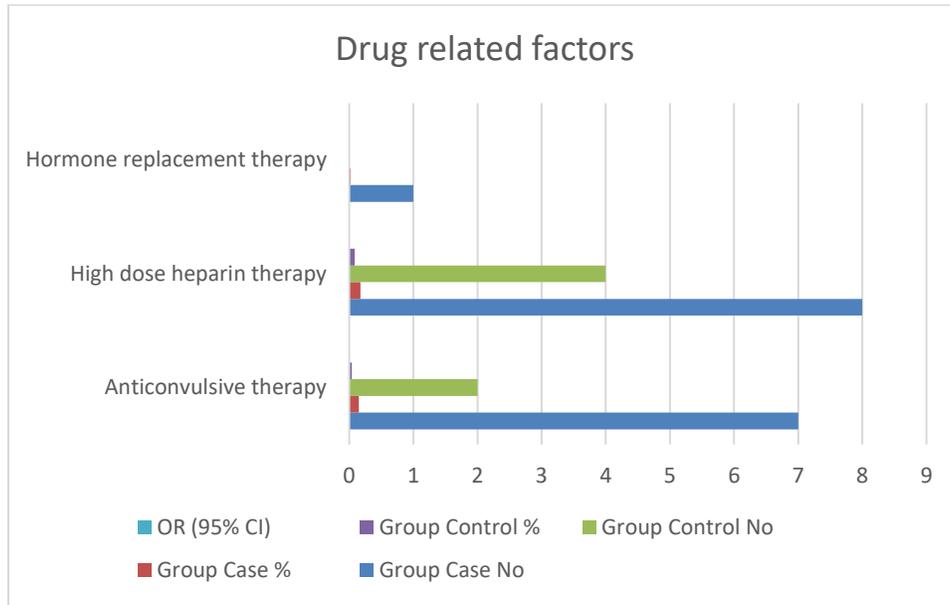
Chart 1D Drug related factors of second hip fracture in osteoporotic patient

Multiple logistic regression model showed that High BMI (>20 Kg/m2), history of having fractures with osteoporosis, and rheumatoid arthritis were the most important risk factors for second fracture among study patients (table 3 & chart 2).

Table 3 multiple stepwise logistic regression for risk factors of second hip fracture in osteoporotic patients

Factors	B	Sig.	OR$_A$	95% CI	
				Lower	Upper
BMI < 20 kg/m2	2.3	0.001*	9.8	2.9	32.9
History of OP fractures	1.3	0.049*	3.7	1.1	14.3
Rheumatoid Arthritis	2.9	0.001*	19.0	3.7	98.2
Constant	-48.0	0.999	0.0		
HL test; significance	$X^2=1.1; .791$				
Model accuracy	76.1%				

B: regression c-efficient   ORA: adjusted odds ratio
CI: confidence interval   HL: Hosmer and Lemeshow Test
* P < 0.05 (significant)
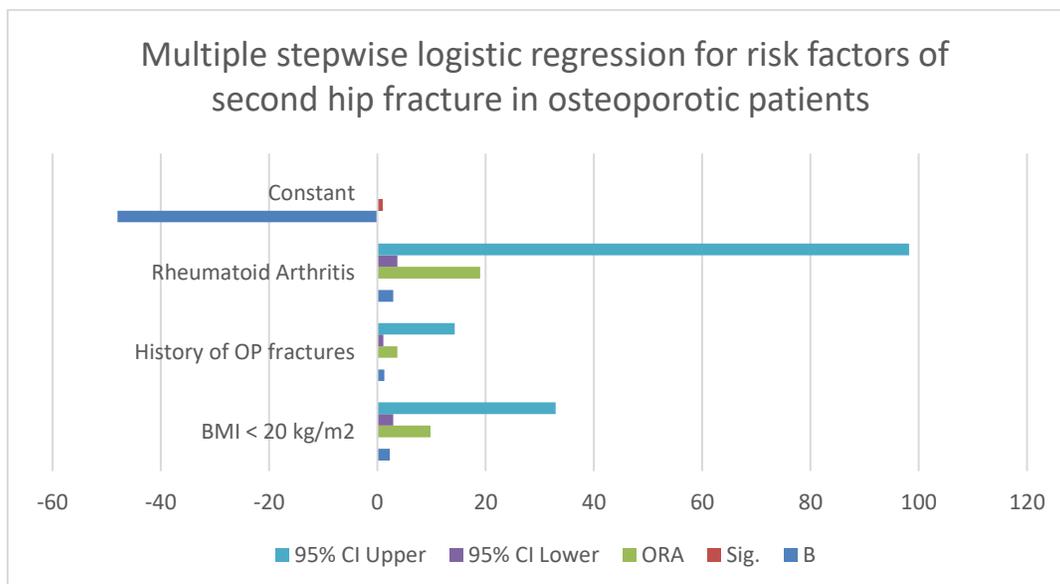
Multiple stepwise logistic regression for risk factors of second hip fracture in osteoporotic patients

Chart legend: 95% CI Upper, 95% CI Lower, ORA, Sig., B

Chart 2 Multiple stepwise logistic regressions for risk factors of second hip fractures in osteoporotic patients

discovery

4. DISCUSSION

Hip fractures are the main causes of hospitalization for elderly patients in many countries. These fractures are associated with a high of mortality, of morbidity casing loss of independence (Keene & Parker 1993, Cumming & Klineberg 1996). Second fracture of the femur as a health burden has not been highlighted adequately in research. Nymark et al., 2006 assessed that second fracture occurs in 8.7%, of which 50% within 12–19 months. Lönnroos et al., 2007 study revealed that 5.1% of second fractures occur after a year and 8.1% after 2 years. Also, Berry et al., 2007 assessed second fractures of 14.8% and up to 2.5% of the cases occur after a year from the first fracture while 8–8.2% after 5 years. Higher rate was reported by Ryg J (2009) study as 16.5% of the patients suffer a second femoral fracture, of which 9% after a year and 20% after 5 years. According to Dretakis et al., 50% of the subjects already refracture within 2 years and 75% within 4 years. Angthong et al. reported a total amount of the second fracture is 5–10%, of which 78.6% occurs in the 12 months after the first fracture. Totally, the frequency of refractures which reported in literature ranged from 2 to 11% after the first fracture. Scaglione et al., 2013 revealed that the percentage of patients with fractures of contralateral femur has resulted in 4.4%, of which 83% were women and 17% men. The second fracture within a year, on 1183 fractured patients resulted in 2.4%. The mean time between the two fractures is of 22 months and 55.7% (29 patients) refractured within 1 year while 90.3% within 5 years.

The current study aimed to assess risk factors of second fracture among osteoporotic patients. Majority of the study patients aged 70 years, or more and more than half of the patients were females which indicate that second fractures were more among females at old age. As for risk factors, body mass index above 20 Kg/m2, history of previous fractures, and rheumatoid arthritis (RA) were the most significant factors. Osteoporotic patients with BMI > 20 Kg/m2 recorded 10 times more risk for refracture than those with lower BMI. This was in contrast to what was reported by Xiang BY et al., who found that higher BMI might play a beneficial impact in men (RR: 0.80, 95% CI: 0.69–0.93; $P = 0.003$), it has little effect in women (RR: 0.91, 95% CI: 0.74–1.11; $P = 0.343$). In addition, an increase in BMI by 5 kg/m2 decreased the risk of fractures in men (RR: 0.90, 95% CI: 0.83–0.98; $P = 0.017$) and women (RR: 0.85, 95% CI: 0.81–0.89; $P < 0.001$). But there were many other studies which approved the role of high body mass index as a predictor for fractures among osteoporotic patients especially females (Pirro et al., 2010; Compston et al., 2014; Asomaning et al., 2006).

Considering rheumatoid arthritis, it significantly increased the risk for second fracture by about 20 folds. This is due to that advancement of RA leads to local and systemic bone loss, and patients eventually develop osteoporosis with higher liability for repeated fractures (Wright et al., 2011; Kim et al., 2016; Wang et al., 2015). Also, do the previous history of fracture where the weak area of first fracture makes it more liable to re-fracture.

5. CONCLUSION

Our study concludes that osteoporotic patients with first hip fracture are highly liable to get the second hip fracture. In particular, BMI> 20 Kg/M2, history of pervious fractures and rheumatoid arthritis were the most significant risk factors. We highly suggest that the ministry of health to implement an effective guidelines in terms of following the elderly patient with first hip fracture. Hence, early detection of osteoporosis would provide the best care for those patients.

Author contributions

Mohammed K Alsaleem worked as a supervisor, created the research idea, design the study and revise the paper before submission. Ali A Alsakak worked as a data collector; facilitate the statistical analysis for the data. Adia A Almutairi helps in data collection and writing the manuscript. Zahrah A AlAbdullah helps in data collection, writing the manuscript and process of submission the paper.

Conflict of interest

The authors declare there is no conflict of interests

Informed consent

Oral consent was obtained from all individual participant included in the study

Ethical approval

This study was approved by medical ethics committee of King Fahad Hospital in Hofuf, Saudi Arabia, number 16-24-2020.

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Data and materials availability

All data associated with this study are present in the paper.

Peer-review

External peer-review was done through double-blind method.

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