

## Research Article

### Hip Fracture Management in an Orthogeriatric Clinical Care Center during the Covid-19 Pandemic in Bogotá, Colombia<sup>1</sup>

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#### Abstract

**Objectives:** This paper aims to compare treatment results on patients 65 years or older with hip fracture during the COVID-19 pandemic with previous treatment results in an Orthogeriatric Clinical Care Center.

**Methods:** A retrospective cohort's study was carried out in elder patients with hip fracture who had surgical management in Bogotá, Colombia before and during the COVID-19 pandemic.

**Results:** Patients admitted during the pandemic were more comorbid. The mean time between admission and surgery was less than 48 hours in both groups and there was no significant difference in in-hospital mortality, delirium, days of hospitalization, readmissions, nor in mortality after 30 and 90 days.

**Discussion:** Standardized orthogeriatric co-management during the COVID-19 pandemic maintained outcomes and results of quality

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indicators similar to those of pre-pandemic times, even though patients seen during the pandemic had a higher burden of comorbidity.

**Keywords:** COVID-19; Hip fracture; Orthogeriatric; SARS - CoV - 2

#### Introduction

From the report of the first cases of infection associated with the new coronavirus (COVID-19, also named as Severe Acute Respiratory Syndrome Coronavirus 2 [SARS-CoV-2]) in Wuhan, China in December 2019 [1], the cases of contagion by this pathogen spread rapidly nationwide and internationally, giving way to the global pandemic decreed by the World Health Organization (WHO) on March 11<sup>th</sup>, 2020 [1-3]. Currently all countries have a large number of infected people, which has become a major threat to health systems and each individual [4]. On March 6<sup>th</sup> 2020, the first case of a patient with COVID-19 infection was reported in Bogotá, Colombia, marking the end of the preparation phase and the beginning of the containment phase in the country [5].

The COVID-19 pandemic has had an important effect on the way in which health organizations provide medical care, focusing on the priority care of urgent pathologies that require immediate management to limit the spread of the disease. The orthopedic and traumatology services initially had to reorganize and cancel a large part of the elective surgeries to focus on those acute pathologies that require prompt attention [6]. With the increase of elderly population worldwide, fragility fractures -especially those of the hip (proximal femur)- have become one of the most prevalent orthopedic pathologies in the emergency department, and despite the fact that orthopedic trauma decreased during confinement, hip fractures remain common in emergency departments [6]. The time between admission and surgery is an important factor to consider in these patients since performing surgery in the first 24 to 72 hours after admission is associated with a lower rate of mortality and certain postoperative complications [7].

Moreover, studies have shown that people with chronic health conditions such as cardiovascular disease, diabetes mellitus and obesity are more likely to become seriously ill from COVID-19, so the incidence of critical illness is higher among people over 65 years of age compared to the general population [8]. Thus, the high risk associated with contracting infection in this population together with the special considerations required in the treatment of hip fracture makes its management particularly challenging.

Several authors in different countries have described the experience of their respective orthopedic surgery departments regarding the management of elderly patients with hip fracture and the special measures taken in relation to COVID-19, and they coincide in certain aspects. First, as an initial screening for admissions to the emergency room, all patients must be questioned about their history of exposure, respiratory symptoms and body temperature. Those with suspected infection should be isolated immediately. The Polymerase Chain Reaction (PCR) test for COVID-19 should be carried out as soon as possible in all patients, taking the necessary preventive

isolation measures until the result is obtained [4,6]. Patients should be operated in the shortest time possible. For those with a positive result in the diagnostic tests, respiratory parameters should be studied prior to surgery. To lessen the risk of cross-infection by COVID-19 in the perioperative period, isolated management and use of regulated operating rooms is recommended, to reduce their hospital stay as much as possible [4,6,9,10].

So far, there seems to be no literature regarding hospital experience in Colombia with management of elderly patients with hip fracture during the current pandemic. This paper aims to describe the changes implemented in the care protocol of the Orthogeriatric Clinical Care Center of our Institution (Fundación Santa Fe de Bogotá [FSFB]) in relation to COVID-19 and how these have affected the management of patients in relation to pre-pandemic experience.

### Measures implemented in the hospital

The Fundación Santa Fe de Bogotá (FSFB) is a university hospital of quaternary care located in the city of Bogotá, Colombia. It has an Orthogeriatric Clinical Care Center accredited by the Joint Commission International (JCI) and the AO Foundation in which a co-management model between Geriatric and Orthopedic services is carried out in patients 65 years or older who arrive at the emergency department and present with a hip fracture.

Since the report of the first case of COVID-19 in Colombia, the hospital's facilities have been restructured to divide the care of patients in emergency services, hospitalization floors, Intensive Care Units (ICU) and operating rooms into COVID-19 and NO COVID-19 zones. Upon admission to the hospital, all patients undergo a risk screening based on their clinical history and symptoms. Those patients with suspected infection (fever, respiratory symptoms, risk of exposure), or with infection previously confirmed by diagnostic test are immediately isolated and redirected to care in the COVID-19 area. Patients without suspicion of infection after the initial screening are attended in the NON COVID-19 area.

Patients who require hospitalization for hip fracture are requested upon admission to perform the PCR test for COVID-19. This test is a prerequisite for any surgical procedure in the hospital. By institutional guideline and based on international protocols, the PCR testing began to be performed in all patients in the FSFB hospital from May 2020. Before this, all the patients were considered suspicious of infection and were treated by the COVID-19 route. The use of face masks is always indicated for both the patient and the entire health team, regardless of the result of the diagnostic test.

In cases of relative emergencies (patients who require surgery within 24 or 48 hours after admission), a complete screening is done with a clinical history that specifically inquires risk factors for exposure to COVID-19; respiratory or gastrointestinal symptoms in the last 14 days; complete physical examination with emphasis on body temperature; pulmonary examination; and PCR test. Patients with a clinical history and physical examination free of suspicion and negative PCR are operated in the NON COVID-19 area of the operating rooms. If there are signs in the medical history or in the physical examination that qualify the patient as suspect of infection -even with a negative PCR test- the patient will be operated in the COVID-19 area. The same applies to those patients who have a positive PCR test. Patients with a positive PCR for COVID-19 are evaluated by the pulmonology service prior to performing surgery for analysis of respiratory parameters and stabilization of these if necessary.

### Methods

A retrospective cohort's study was carried out in patients taken care of in the Orthogeriatric Clinical Care Center of the FSFB treated before and during the COVID-19 pandemic. The study was approved by the corporate research ethics committee of the FSFB University Hospital that are guided by The World Medical Association's (WMA) Declaration of Helsinki "as a statement of ethical principles for medical research involving human subjects, including research on identifiable human material and data" (WMA, 1964/2018).

For the group under study (patients admitted since the beginning of the COVID-19 pandemic), all patients in the Orthogeriatric Clinical Care Center between March 11, 2020, and March 11, 2021, were selected. The total sample obtained was 73 patients. For the control group, patients seen a year earlier during the same period (March 11, 2018 and March 11, 2019) were selected, for a total of 69 patients. The inclusion criteria were: patients 65 years or older, informed consent signed where they stated they agreed with the procedure and admission to the Orthogeriatric Clinical Care Center, diagnosis of hip fracture due to fragility or peri-prosthetic hip fracture confirmed by radiography. Exclusion criteria were: hip fracture secondary to polytrauma or high energy trauma, hip fracture that is associated with tumor or metastatic disease and hip fractures that were 7 days or older from the arrival to the emergency department.

Sociodemographic data was collected, including age, sex, Body Mass Index (BMI), fracture classification (according to AO Trauma and Vancouver classification) and Charlson Comorbidity Index (CCI). Within the clinical and surgical parameters, the Confusion Assessment Method (CAM) score, laboratories upon admission (hemoglobin, hematocrit, PTH, calcium, phosphorus, vitamin D levels), postoperative hemoglobin and hematocrit at 6 and 24 hours, type of surgical procedure, duration of the procedure and type of anesthesia were recorded; as well as the presence of respiratory symptoms, fever, and PCR test results in patients treated during the pandemic.

Inpatient complications -pressure ulcer, nosocomial pneumonia, Urinary Tract Infection (UTI), transfusional requirement, Admission to Intensive Care Unit (ICU), requirement of vasopressor support, surgical site infection, Acute Myocardial Infarction (AMI), Acute Kidney Injury failure (AKI), respiratory failure, cerebrovascular accident, Deep Vein Thrombosis (DVT) and Pulmonary thromboembolism (PE)-, and the main quality measures of the Orthogeriatric Clinical Care Center -time to surgery, delirium, length of hospital stay, in-hospital death, readmission at 30 days, death at 30 or 90 days- were also recorded.

### Data analysis

An exploratory analysis of the variables was carried out by calculating proportions and frequencies for the discrete variables and measures of central tendency, dispersion, maximum and minimum for continuous variables. The Shapiro-Wilk test was applied as a normality test. To analyze differences between the two study groups, the proportions comparison test and the chi-square test were implemented, as well as the T test and the Mann-Whitney test to compare the continuous variables by period. All analyzes were performed with SPSS software v. 26.0 and Real Statistics v. 7.3 and values of  $p < 0.05$  were considered statistically significant.

## Results

The mean age of the group treated during the pandemic was 83.9 years ( $\pm 0.9$ ) and for patients attended before the pandemic was 81.7 years ( $\pm 1$ ). There was a predominance of women in both groups (71% pre-pandemic vs. 82.2% during the pandemic). No significant differences were found between the sociodemographic data of age, sex, BMI, and type of fracture. A significant difference was observed between the CCI scores, finding that 78.1% of the patients treated during the pandemic had a high level of comorbidity (score greater than or equal to 3) compared to 44.9% in those of the pre-pandemic period (CI 95% 0.08, 0.49;  $p < 0.001$ ) (Table 1). No significant differences were found regarding clinical parameters.

Sociodemographic data				
Variable	Pre - pandemic (n = 69)	Pandemic pe- riod (n = 73)	p	95% CI
Age (years) (mean $\pm$ SE)	81.7 $\pm$ 1	83.9 $\pm$ 0.9	0.09	(-0.35, 4.8)
Sex (%)			0.164	
Male	20 (29%)	13 (17.8%)		(-0.35, 0.29)
Female	49 (71%)	60 (82.2%)		(-0.04, 0.27)
Body mass index (BMI) kg/m2 (mean $\pm$ SE)	25 $\pm$ 0.4	23.9 $\pm$ 0.5	0.073	(-2.37, 0.10)
Fracture classifi- cation (AO, Vancouver) (%)			0.45	
31-A1	13 (18.8%)	12 (16.4%)		(-0.32, 0.27)
31-A2	17 (24.6%)	24 (32.9%)		(-0.19, 0.36)
31-A3	8 (11.6%)	6 (8.2%)		(-0.34, 0.27)
31-B1	11 (15.9%)	9 (12.3%)		(-0.34, 0.26)
31-B2	11 (15.9%)	17 (23.3%)		(-0.22, 0.36)
31-B3	6 (8.7%)	1 (1.4%)		(-0.39, 0.24)
Vancouver B	2 (2.9%)	2 (2.7%)		(-0.32, 0.32)
Vancouver C	1 (1.4%)	2 (2.7%)		(-0.31, 0.33)
Charlson Co- morbidty Index (CCI) (%)			<0.001 *	
No comorbidity (0-1 points)	24 (34.8%)	7 (9.6%)		(-0.59, -0.006)
Low comorbidity (2 points)	5 (7.2%)	7 (9.6%)		(-0.31, 0.34)
High comorbidity (3 or more points)	31 (44.9%)	57 (78.1%)		(0.08, 0.49)
Missing data	9 (13%)	2 (2.7%)		

**Table 1:** Sociodemographic data of patients seen before and during the pandemic.

\*SE = standard error

\*Highlighted p-values indicate statistically significant value.

Source: own work

Among the patients admitted during the pandemic, there were seven patients with symptoms associated with suspected COVID-19 infection (4 with respiratory symptoms and 3 patients with fever on admission), 61 patients underwent a PCR test on admission (83.5%), and only one patient had a positive PCR result (Table 2).

Clinical parameters				
Variable	Pre-pandemic (n = 69)	Pandemic period (n = 73)	p	95% CI
Preoperative CAM scale (%)			0.596	
0	53 (76.8%)	54 (73.9%)		(-0.21, 0.07)
1	5 (7.2%)	6 (8.2%)		(-0.32, 0.33)
2	2 (2.8%)	6 (8.2%)		(-0.28, 0.38)
3	1 (1.4%)	2 (2.7%)		(-0.33, 0.35)
Missing data	8 (11.6)	5 (6.8)		
Respiratory symptoms on admission (%)				
Yes	-	6 (8.2%)		
No	-	67 (91.8%)		
Fever on admis- sion (%)				
Yes		3 (4.1%)		
No		70 (95.9%)		
PCR for COVID-19 (%)				
Positive		1 (1.4%)		
Negative		59 (80.8%)		
No test		13 (17.8%)		
Preoperative He- moglobin (g/dL) (mean $\pm$ SE)	13.7 $\pm$ 0.2	12.8 $\pm$ 0.2	0.013*	(-1.51, -0.18)
Preoperative He- matocrit (g/dL) (mean $\pm$ SE)	40.8 $\pm$ 0.7	38.9 $\pm$ 0.7	0.05	(-3.86, 0.01)
Hemoglobin 6 hours after surgery (g/dL) (mean $\pm$ SE)	11.4 $\pm$ 0.2	10.8 $\pm$ 0.2	0.043*	(-1.24, -0.02)
Hematocrit 6 hours after surgery (g/dL) (mean $\pm$ SE)	33.9 $\pm$ 0.6	32.8 $\pm$ 0.6	0.201	(-2.99, 0.64)
Hemoglobin 24 hours after surgery (g/dL) (mean $\pm$ SE)	14.4 $\pm$ 2.2	10.1 $\pm$ 0.2	0.059	(-8.78, 0.18)
Hematocrit 24 hours after surgery (g/dL) (mean $\pm$ SE)	34.1 $\pm$ 1.8	30.6 $\pm$ 0.7	0.077	(-7.35, 0.39)

**Table 2:** Clinical parameters of patients seen before and during the pandemic.

\*SE = standard error

\*Highlighted p-values indicate statistically significant value.

Source: own work

Regarding surgical information, there was a statistically significant difference in the type of anesthesia used, with a predominance of general anesthesia in the pre-pandemic group and regional anesthesia

in the pandemic group (CI 95% -0.52, -0.05;  $p < 0.001$ ) (Table 3). The average duration of surgery between the pre-pandemic and pandemic group was 87.8 ( $\pm 4.8$ ) minutes and 103.9 ( $\pm 4.7$ ) minutes, respectively, with a statistically significant difference (CI 95% 2.81, 29.2;  $p = 0.017$ ).

Surgical information				
Variable	Pre-pandemic (n = 69)	Pandemic period (n = 73)	p	95% CI
Procedure (%)			0.278	
Arthroplasty	19 (27.5 %)	21 (28.8%)		(-0.26, 0.29)
Open reduction with internal fixation	28 (40.6 %)	37 (50.7%)		(-0.14, 0.34)
Closed reduction with internal fixation	22 (31.9 %)	15 (20.5%)		(-0.39, 0.16)
Length of the procedure (minutes) (mean $\pm$ SE)	87.8 $\pm$ 4.8	103.9 $\pm$ 4.7	0.017*	(2.81, 29.2)
Type of anesthesia			<0.001*	
General	44 (63.7 %)	26 (35.6%)		(-0.52, -0.05)
Spinal	19 (27.5 %)	25 (34.2%)		(-0.21, 0.33)
Regional	3 (4.3 %)	22 (30.1%)		(-0.04, 0.55)
Local assisted	3 (2.8 %)	0 (0.0 %)		
Missing data	1 (1.4)			

**Table 3:** Surgical information of patients seen before and during the pandemic.

\*SE = standard error

\*Highlighted p-values indicate statistically significant value

Source: own work

As for hospital complications, a higher number of patients seen during the pandemic presented urinary tract infection and required transfusion of packed red blood cells (Table 4).

Among the quality measures of the Orthogeriatric Clinical Care Center, it was found that the average time from admission until the beginning of surgery was 29.8 ( $\pm 4.9$ ) hours in the pre-pandemic group and 36 ( $\pm 1.7$ ) hours in the pandemic group, with a statistically significant difference (CI 95% 1.13, 11.2;  $p = 0.017$ ). As well, the length of hospitalization averaged 5.3 ( $\pm 0.3$ ) days in the first group and 5.5 ( $\pm 0.4$ ) in the second group in which there was no statistical significant difference. There were no statistically significant differences regarding hospital delirium, in-hospital death, readmission at 30 days, and death at 30 and 90 days (Table 5).

## Discussion

Fragility hip fractures in patients 65 years or older have a great impact on life quality, functionality and mortality during the first year after the event [11]. Studies have shown that half of these patients do not regain their pre-fracture mobility, and have in-hospital mortality figures of 7%, 30 day mortality between 5% and 10% and 20% to 30% mortality one year after the procedure [12-14]. Because of this, specialized care in geriatric patients with hip fracture is necessary.

The implementation of orthogeriatric centers for the treatment of patients with fragility hip fractures has had a favorable impact in terms of reducing morbidity and mortality. Henderson et al., found

In-hospital complications				
Variable	Pre-pandemic (n = 69)	Pandemic period (n = 73)	p	95% CI
Pressure ulcer	3 (4.3 %)	10 (13.7 %)	0.079	(0.91, 13.2)
Nosocomial pneumonia	1 (1.4 %)	1 (1.4 %)	1.000	(0.05, 15.4)
Urinary tract infection	2 (2.9 %)	9 (12.3 %)	0.056	(0.98, 22.6)
Transfusion requirement	24 (34.8 %)	35 (47.9 %)	0.127	(-0.12, 0.38)
Intensive care unit admission	18 (26.1 %)	14 (19.2 %)	0.422	(0.30, 1.48)
Vasopressor requirement	11 (15.9 %)	14 (19.2 %)	0.664	(0.52, 2.98)
Surgical site infection	0 (0.0 %)	0 (0.0 %)		
Acute myocardial infarction	1 (1.4 %)	1 (1.4 %)	1.000	(0.05, 15.4)
Acute kidney injury	3 (4.3 %)	0 (0.0 %)	0.112	
Respiratory failure	2 (2.9 %)	2 (2.7 %)	1.000	(0.12, 6.89)
Deep vein thrombosis	1 (1.4 %)	0 (0.0 %)	0.486	
Pulmonary thromboembolism	1 (1.4 %)	3 (4.1 %)	0.62	(0.29, 28.7)

**Table 4:** In-hospital complications of patients treated before and during the pandemic.

\*SE = standard error

\*Highlighted p-values indicate statistically significant value.

Source: own work

Quality indicators of the Orthogeriatric Program				
Variable	Pre-pandemic (n = 69)	Pandemic period (n = 73)	p	95% CI
Time from admission until surgery (hours) (mean $\pm$ SE)	29.8 $\pm$ 4.9	36 $\pm$ 1.7	0.017*	(1.13, 11.2)
In-hospital delirium (%)	11 (15.9 %)	13 (17.8 %)	0.825	(0.47, 2.75)
Length of stay (days) (mean $\pm$ SE)	5.3 ( $\pm 0.3$ )	5.5 ( $\pm 0.4$ )	0.781	(-0.81, 1.07)
In-hospital death	1 (1.4 %)	2 (2.7 %)	1.000	(0.17, 21.6)
Readmission within 30 days	8 (11.6 %)	8 (11 %)	1.000	(0.33, 2.65)
30-Day Mortality	4 (5.8 %)	2 (2.7 %)	0.432	(0.08, 2.58)
90-Day Mortality	4 (5.8%)	8 (11%)	0.369	(0.57, 6.97)

**Table 5:** Quality indicators of the orthogeriatric program of patients treated before and during the pandemic.

\*SE = standard error

\*Highlighted p-values indicate statistically significant value.

Source: own work

that after a joint management between orthopedics and geriatrics in elderly patients with hip fracture, there was a significant decrease in annual mortality, from 19% with standard orthopedic management



to 9.7% after establishing an orthogeriatric service; as well as a decrease in in-hospital mortality and length of hospitalization [15]. At the FSFB University Hospital, there is a co-management program between orthopedics and geriatrics for all patients 65 years or older who present with a fragility hip fracture, which follows a specific management protocol with the aim of reducing the time from admission to surgery, complications and hospital stay to reduce functional dependence, morbidity, as well as short - and long-term mortality.

In this study, the sociodemographic, clinical characteristics and outcomes of surgical management of patients 65 years or older with hip fracture treated during the COVID-19 pandemic by an Orthogeriatric Clinical Care Center were collected and compared with a group of patients with similar characteristics attended by the same center prior to the COVID-19 pandemic. Within the group treated during the pandemic, a PCR test for COVID-19 was performed on 59 of the 73 patients, in which only one patient had a positive result. The 13 patients not tested were treated at the beginning of the pandemic when the PCR test was not fully available in our institution and wasn't required for surgical procedures. A CCI indicative of high comorbidity (3 or more points) was found in 78.1 % of the cases treated during the pandemic compared to 44.9% of patients in the pre-pandemic group (CI 95% 0.08, 0.49;  $p < 0.001$ ). The aforementioned shows a greater burden of morbidity and risk of mortality in the group admitted during the pandemic. There was a significant decrease in the implementation of general anesthesia and increased use of spinal and regional anesthesia during surgery in the pandemic group in contrast to the previous period (CI 95% -0.52, -0.05;  $p < 0.001$ ). Endotracheal intubation is a high-risk procedure for exposure and transmission of the virus due to the high load of the virus found in respiratory secretions [16], which justifies the change in anesthetic behavior.

The average time from admission to surgery was 29.8 hours and 36 hours before and during the pandemic, respectively, with a statistically significant difference (CI 95% 1.13, 11.2;  $p = 0.017$ ). The increase in time between one period and the other can be associated with the protective and diagnostic measures added to the management protocol in relation to COVID-19. However, it should be noted that both groups still present times below 48 hours, which is associated with a lower risk of nosocomial complications and mortality in these patients [7] and is one of our Orthogeriatric Clinical Care Center goals. It was also found that the mean duration of surgery in patients managed during the pandemic ( $103.9 \pm 4.7$  minutes) was significantly higher when compared to the pre pandemic group ( $87.8 \pm 4.8$  minutes) (CI 95% 2.81, 29.2;  $p = 0.017$ ). At the beginning of the pandemic, all patients admitted with a hip fragility fracture were taken to the operating room without a RT-PCR screening test.

Therefore, all the operating room personnel had to comply with strict safety measures such as the use of a surgical scrub suit, isolation suit, disposable surgical gown, three disposable latex surgical gloves, disposable fitted N-95, face-shield and eyewear protection during the procedure. These safety measures made it difficult for the surgery team to perform the same way as when operating in normal conditions. As the PCR test was introduced at the FSFB, all patients admitted to the hospital who needed to undergo a surgical procedure had to have a test result. Depending on the result, the use of intraoperative security measures were established as mentioned before.

The cohort of patients seen during the pandemic presented more cases of UTI and had a higher postoperative transfusional requirement. The latter may be associated with the greater burden of

comorbidities and the longer duration of the surgical procedure found in this cohort. No statistically significant difference was found regarding ICU admission, incidence of delirium, length of hospitalization, in-hospital mortality or readmission. In terms of early mortality after hip fracture surgery in patients with diagnosed COVID-19, a systematic review by Wang et al., found that there was a 32.6% death rate in patients with COVID-19 and concomitant hip fracture surgery [17]. Additionally, they found that patients that did not have a diagnosis of COVID-19 compared to those who did, had a relative risk ratio for early mortality of 5.66 (95% IC 4.01, 7.98;  $p < 0.001$ ) [17]. In the present study, no statistically significant differences were found for mortality at 30 days and 90 days after the procedure between both groups.

Despite having just one patient with a positive test result for COVID-19, it was considered of great importance to be able to determine whether the infection prevention measures integrated into the management algorithm of patients could have any impact on their main outcomes, which did not happen. The main weakness of this study was the small size of the sample collected. Thus, it is important that similar studies are carried out with larger samples to establish stronger associations for the outcomes of this vulnerable population.

## Conclusion

In conclusion, even though patients of 65 years or older who arrived at the emergency department with a hip fracture during the pandemic were more comorbid -which gives them a greater potential for complication- and had to comply with the measures added to the treatment algorithm of the orthogeriatric program in relation to COVID-19, it is possible to uphold the management path that these patients require, which has a positive effect on their clinical outcomes. This makes evident the significant benefit of co-management between orthopedics and geriatrics through standardized protocols in this patient population.

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## Declaration of Conflicting Interests

All authors declare that there is no conflict of interest.

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