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Original article

Fast track care for pertrochanteric hip fractures: How does it impact length of stay and complications?☆

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ABSTRACT

Introduction: The medical and economic impact of treating pertrochanteric hip fractures is growing. We hypothesized that fast track surgery of pertrochanteric fractures would reduce the length of stay (LOS) without compromising the quality of care.

Materials and methods: This was a prospective, observational, single-center cohort study conducted between 2014 and 2016 at the Angers Teaching Hospital in France. The enrolled patients had an isolated A1 or A2 proximal femur fracture (AO classification) that was treated surgically by intramedullary nailing and required post-acute rehabilitation (PAR) care. The exposed FT cohort was transferred into the PAR pathway on postoperative day 1. The non-exposed (control) group was provided with postoperative care in the surgery unit before transfer to PAR. The primary outcome was the total LOS (LOS in surgery + LOS in PAR). The secondary objectives were to determine the immediate survival, 1-year survival, postoperative complications and average cost of hospitalization.

Results: The study enrolled 109 patients initially, with 54 patients eligible for analysis after matching (27 pairs). The LOS in PAR and total LOS were 45.85 ± 19.24 days and 48.56 ± 19.36 days in the FT group ($n = 27$), and 68.41 ± 48.77 days and 77.85 ± 48.80 days in the control group ($n = 27$). Thus the LOS in PAR and total LOS were significantly lower in the FT group ($p = 0.022$, $p = 0.003$). There was no significant difference in the number of early deaths, complications, and 1-year survival without rehospitalization between cohorts. The mean cost per patient was lower in the FT cohort.

Discussion: The FT pathway has already been adopted in orthopedics. For patient who suffer a hip fracture, it contributes to reducing the total LOS without negatively impacting the quality of care. Early health economics studies support this care pathway.

Conclusion: The FT approach to treating pertrochanteric fractures reduces total LOS without increasing mortality or complication rates. The 1-year survival is comparable.

Level of evidence: IIB, Exposed/Unexposed cohort.

1. Introduction

Surgical treatment of pertrochanteric fractures is associated with a prolonged stay in the hospital with the length of stay (LOS) averaging 15.5 days in 2002 and 12 days in 2009 [1]. However, this LOS data does not capture the stay in the post-acute rehabilitation (PAR) center, which adds to the overall hospital stay and cost for the insurer.

Proximal femur fractures (PFF) are the most common trauma-related fracture; 65% of them are pertrochanteric fractures. The frequency of extracapsular fractures in adults over 80 years of age is increasing [2,3]. In France, there were 50,000 PFF in 1990 and this number is estimated to triple by 2050 [1]. On a global scale, there were approximately 1.66 million PFFs in 2000 and this number is expected to increase 6-fold by 2050 [4]. Pertrochanteric fractures

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mainly occur in a frail geriatric population. Despite the advances in orthopedic surgery and anesthesia, the mortality rate is 15% to 30% in the first year post-fracture [5]. This major public health issue led us to ask how the care pathway can be improved, given the growing number of older hip fracture patients. The fast track (FT) sector of a surgical unit is expected to reduce dependency, limit exposure to nosocomial infections and improve patient satisfaction. It encourages healthcare facilities to optimize their technical capabilities. Ultimately, it reduces direct costs by 25% to 68% depending on the surgical procedure studied [6–8].

To our knowledge, the impact of FT care on the total LOS for PFF has never been studied. The primary aim of our study was to evaluate the total LOS of patients who suffer a pertrochanteric fracture and are treated surgically. We hypothesized that FT care of pertrochanteric fractures would reduce the acute LOS at the hospital and the total LOS.

2. Materials and methods

2.1. Study population

This was a prospective, observational, non-randomized, single-center cohort study performed between 2014 and 2016 at the Angers Teaching Hospital in France. The enrolled patients had a pertrochanteric fracture treated surgically by intramedullary nailing.

To be included, patients had to have an isolated, trauma-related type A1 or A2 pertrochanteric fracture (AO classification) and be eligible for transfer to a partner PAR facility. The criteria for a PAR request were a frail patient, and/or living at home alone, and/or primary care giver cannot provide sufficient care, and/or elderly. Patients were excluded if they had another concurrent or acute ailment or were transferred to another PAR facility other than the partner one. Before matching, 109 patients were eligible: 74 who were treated in the FT pathway (exposed cohort) and 35 who were not (unexposed or control cohort). Matching was done based on age (within 4 years), gender, residential status and autonomy level at admission. After matching, we were left with 27 pairs for analysis and the two cohorts were comparable (Table 1).

2.2. Methods

The care pathway is summarized in Fig. 1. The partner PAR facility employed geriatricians, nurses, nursing aids and physical therapists. The same staff was assigned to both groups of patients.

A standardized computerized record was set up for each patient at their enrollment and completed during the follow-up period. For the 1-year postoperative visit, information was collected from the patient's medical records, the family doctor, an assigned caregiver, or the patient himself/herself. No patients were lost to follow-up.

The same surgery was performed in both groups by the same team of senior surgeons. A closed procedure with PFNA^{TM} instrumentation (DePuy-Synthes, Saint-Priest, France), reduction on traction table in dorsal decubitus under fluoroscopy control. No drains were used in either group. The surgery was done under general anesthesia supplemented by an ultrasound-guided femoral nerve block. Food was allowed once the patient was discharged from the post-anesthesia care unit. X-rays were also taken at this point.

The mean cost per patient was calculated using the price of one night of hospitalization in the surgery unit (1145.55 euros) and one night in the PAR facility (523.95 euros), based on the regional health agency's (ARS) fixed rates in July 2014.

2.3. Assessment methods

The primary outcome was the total LOS that we defined as the sum of the acute phase LOS in surgery and the PAR center (total LOS = surgery LOS + PAR LOS). The secondary outcomes were the early mortality rate, postoperative complication rate, 1-year survival without rehospitalization, overall cost of the stay.

2.4. Statistical analysis

The statistical analysis was performed with R software (version 3.4.2, R Foundation for Statistical Computing, Vienna, Austria). As there is no published data on our total LOS outcome that could be used to determine sample size, all patients meeting the inclusion criteria were enrolled over a 2-year period. Bootstrapping was used to compare mean values. Percentages were compared with the McNemar test. Survival without rehospitalization was compared using a Cox proportional hazards models stratified on matched pairs. A P value of less than 0.05 was considered as statistically significant. No correction for multiple comparisons was done.

3. Results

3.1. Total LOS

The total LOS was significantly lower in the FT group (48.56 ± 19.36 days) than the control group (77.85 ± 48.80 days), as were the surgery LOS and PAR LOS (Table 2).

Table 1
Characteristics of the study participants.

	Fast track (exposed) group (n = 27) Mean ± SD[†]	Control (nonexposed) group (n = 27) Mean ± SD[†]	p
Age (years)	84.5 ± 8.7	85.0 ± 8.5	*
Sex (M/F)	7 M/20 F	7 M/20 F	*
Preop Parker	5.78 ± 2.56	5.96 ± 2.58	0.56
Preop ASA	2.33 ± 0.68	2.41 ± 0.89	0.72
	N (%)	N (%)	
Cognitive disorders (preop MMS < 25)	13 (48.1%)	12 (44.4%)	0.75
Cardiovascular comorbidities	23 (85.2%)	24 (88.9%)	0.73
Cancer	2 (7.4%)	2 (7.4%)	1.0
Anticoagulant therapy	7 (25.9%)	9 (33.3%)	0.58
At home with help	11	11	*
At home without help	16	16	*
Retirement home	0	0	*

[†] Standard deviation.
* Comparison not done because equality ensured by matching.

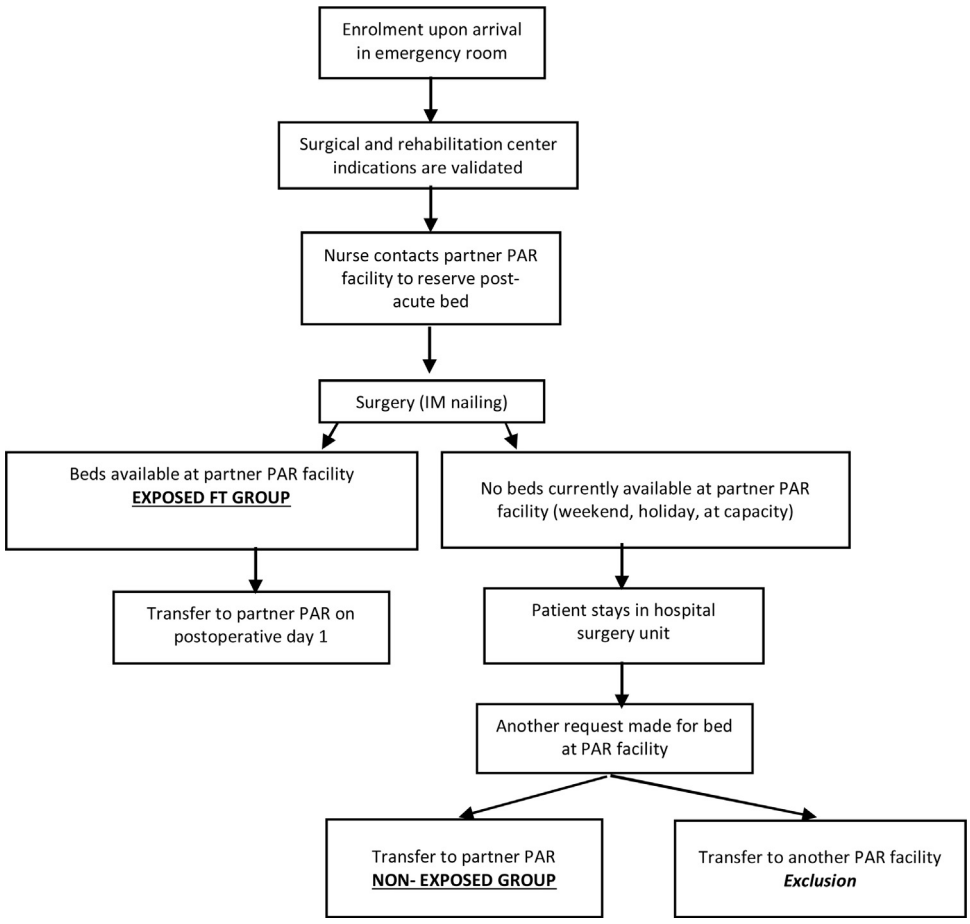

Fig. 1. Care pathway used in our study of pertrochanteric fractures. At our hospital, the fast-track sector is a dedicated unit and the post-acute rehabilitation center is a partner facility (IM: intramedullary; PAR: post-acute rehabilitation).

Table 2
Primary and secondary outcome measures.

	Fast track (exposed) group Mean ± SD[†]	Control (nonexposed) group Mean ± SD[†]	Difference	*p*
LOS[*] (days)				
Surgery	2.70 ± 0.91	9.44 ± 4.29	6.74 ± 4.02	< 0.0001
PAR	45.85 ± 19.24	68.41 ± 48.77	22.56 ± 56.26	0.022
Total	48.56 ± 19.36	77.85 ± 48.80	29.30 ± 55.9	0.003
Time to surgery (hours)	32.90 ± 24.1	55.10 ± 38.7	22.20 ± 47.5	0.008
Number of complications				
Surgery	0.11 ± 0.32	0.44 ± 0.70	0.33 ± 0.73	0.012
PAR	1.59 ± 1.28	0.96 ± 1.19	−0.63 ± 1.57	0.042
Overall	1.70 ± 1.32	1.41 ± 1.58	−0.30 ± 1.88	0.42
Cost per patient				
Surgery	1 952 ± 1 045€	9,674 ± 4,915€	7,722 ± 4,611 €	< 0.0001
PAR	23 500 ± 10 083€	35,338 ± 25,527€	11,837 ± 2,9454 €	0.021
Overall	25 452 ± 10 248€	45,011 ± 25,808€	19,559 ± 2,9233 €	0.0002
	N (%)	N (%)		
Died while still in hospital	0 (0%)	4 (14.8%)	14.8%	0.06
Rehospitalized within 1 year				
Related[**]	3 (11.1%)	3 (11.1%)	0%	
Unrelated[**] Total	4 (14.8%) 7 (25.9%)	6 (22.2%) 9 (33.3%)	7.4% 7.4%	
Survival at 1 year				
Death	6 (22.2%)	6 (22.2%)	0%	
Survival without rehospitalization	14 (51.9%)	12 (44.4%)	−7.4%	0.67

[†] Standard deviation.
[*] Mean length of stay.
[**] With surgery or a fall.

Table 3
Complications found in both groups.

	Fast track (exposed) group n (%)	Control (nonexposed) group n (%)
Acute decompensated heart failure	6 (22.2%)	7 (25.9%)
Transfusion	7 (25.9%)	4 (14.8%)
Confusion	6 (22.2%)	3 (11.1%)
Respiratory decompensation	1 (3.7%)	8 (29.6%)
Bed sores	5 (18.5%)	4 (14.8%)
Urinary infection	4 (14.8%)	5 (18.5%)
Lung infection	3 (11.1%)	5 (18.5%)
Acute urinary retention	7 (25.9%)	1 (3.7%)
Bleeding at surgical site	5 (18.5%)	0 (0%)
Other complications	0 (0%)	4 (14.8%)
Thromboembolism	1 (3.7%)	1 (3.7%)
Acute coronary syndrome	1 (3.7%)	0 (0%)

3.2. Mortality rate

The difference between the short-term mortality rate (at PAR discharge) was not significant (Table 2). There were four deaths in the control group: one cardiac arrest with decision to stop active treatment and three cases of pneumonia. There were no deaths in the FT group.

3.3. Complications

There was no significant difference in the total LOS when all the complications pooled (Table 2). There were significantly more complications in the surgery unit in the control group and more complications at the PAR facility in the FT group (Table 3).

3.4. 1-year survival without rehospitalization

There was no significant different in the 1-year survival without rehospitalization (Table 2) (Hazard Ratio = 1.20, 95% CI: 0.52 to 2.78, $p = 0.67$) (Fig. 2).

3.5. Cost of stay

The mean total cost per patient was reduced by 19,559 euros (95% CI: 9,495 to 33,765) in the FT group (Table 2, Fig. 3).

3.6. Time to surgery

The mean time to surgery was shorter in the FT group (32.90 ± 24.1 hours) than in the control group (55.10 ± 38.7 hours), which amounted to a significant decrease of 22.20 ± 47.5 hours ($p = 0.008$) (Table 2).

4. Discussion

Our hypothesis was confirmed, as the FT group had their total LOS shortened by an average of 29.29 days ($p = 0.003$). There was no significant difference between the two groups in the overall complication rate during the combined stay. While the shorter LOS in surgery artificially lowered the complication rate in this unit, this was partially or totally made up for by the occurrence of complications in PAR. Moreover, we found a lower drop in hospitalization-free survival at 3 months, like Hahnel [9].

We found that a rapid discharge from the surgery unit is significantly correlated with an early discharge from the PAR facility, with no significant difference in the mortality rate, early complication rate or 1-year survival rate. There was a trend toward lower postoperative mortality in the FT group (0 in the FT vs 4 in the control group); however, the small sample size and lack of power made it impossible to verify this finding statistically.

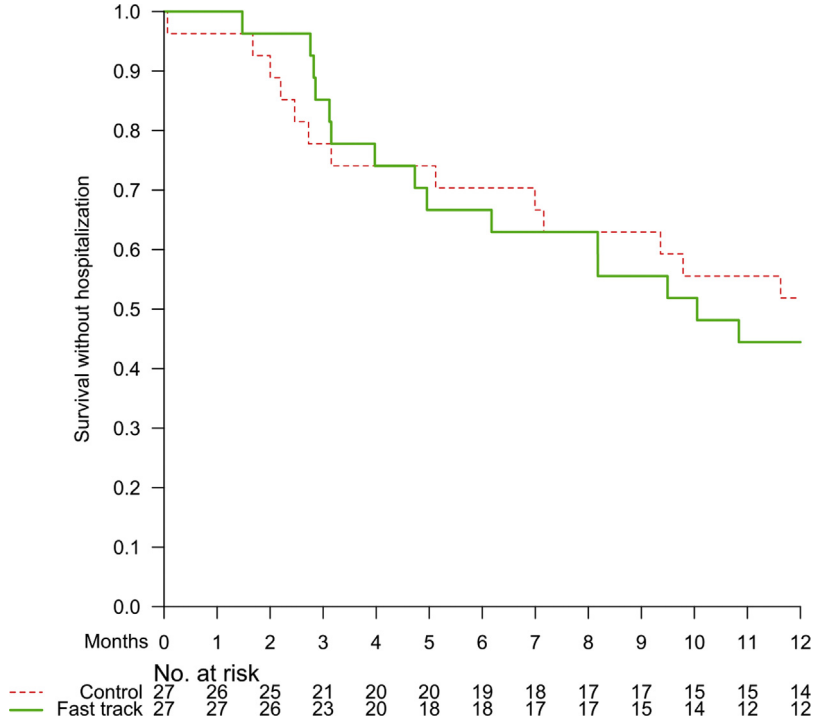

Fig. 2. Kaplan-Meier survival estimates at 1 year. No patient considered as alive was rehospitalized, independent of the cause after his/her discharge.

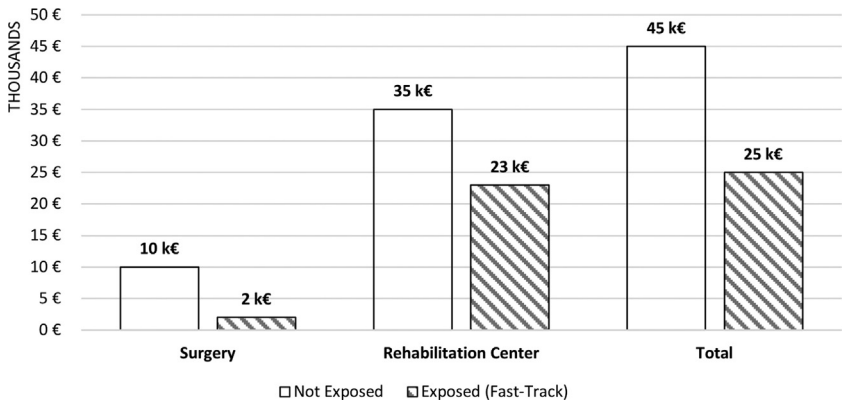

Fig. 3. Average cost per patient based on the price of a night in surgery and in post-acute rehabilitation, in full hospitalization on the rates set by the ARS in July 2014.

The reduction in total LOS between the two groups can be explained by the cumulative effect of multiple factors. Prolonged hospitalization in the surgery unit instead of the rehabilitation unit delays full standing and makes the patients dependent [10]. This contributes to the occurrence of complications and increase the length of the acute phase stay [11]. Early medical and functional care reduces the complications specific to a geriatric population [10]. The diagnosis of medical complications in the surgery unit can be delayed, resulting in longer and/or more complicated care requirements [12]. The implementation of medical services or early transfer to dedicated unit improves the overall quality of care. Our study supports an alternative to the current model of geriatric perioperative care, which shortens the length of stay, improves functional scores and reduces postoperative complications, intrahospital mortality at 6 months [13–15] and intrahospital costs [16]. Moreover, the FT "label" seems to collectively energize the staff. In our study, the time to surgery was significantly lower in the FT group (32.89 ± 24.14 hours versus 55.11 ± 38.71 hours, $p = 0.008$) without any instructions being given. Spontaneously, the teams accelerated their care provision before the surgery. Thus, we observed an "FT effect" on behaviors.

The economic impact of this care pathway must also be emphasized. Based on the hospitalization costs, there was a clear benefit to the FT pathway. The mean cost of a patient in the FT pathway in our study was 2000 € in surgery. By comparison, in Belgium in 1996, the cost of hospitalization for hip fracture surgery was 8667 € [17], in Great Britain it was 7028 €, in the United States it was 10,936 €, and in France it was 9296 € [3]. The mean overall cost of care was 25,000 € for an FT patient versus 45,000 € for a patient in the standard care pathway (Fig. 3). This represents a savings of 20,000 € per FT patient.

The patient's autonomy at discharge is another important parameter. The medium- and long-term consequences of a PFF are catastrophic from a functional standpoint. Nikitovic estimates that 40% of patients do not regain their prefracture mobility 1 year later, 35% require aid during walking and 20% are admitted to a long-term care facility [18]. Our study's findings need to be validated in a large prospective study including all types of PFF that will also evaluate quality of life and autonomy at discharge. Another factor with major impact is the time to surgery. Recent studies have shown the prognosis is severely impacted after 48 hours [19]. Thus efforts must be made both before and after the surgery.

Our study had several strengths. It was prospective, comparative and used matched cases. The patients were operated using the same procedure and were discharged to the same PAR facility; the same rehabilitation team treated both patient cohorts to ensure uniform care. Lastly, to the best of our knowledge, this was the first prospective study of a FT pathway in the context of pertrochanteric fractures in older adults. Our study also had limitations. It was impossible to randomize our patients because the availability of PAR beds could not be predicted beforehand. In addition, the group size was small.

5. Conclusion

This prospective study evaluates the LOS in surgery and PAR in the context of pertrochanteric fracture. It shows that the FT pathway reduces the hospitalization time without negatively affecting the chance to survive in the short and long term. Our study reinforces the relevance of improving the orthogeriatric surgical care model. This model appears to be effective and doable on a national and international level, with a favorable cost-benefit ratio [20].

The FT trend in orthopedics is here to stay. There is no reason this accelerated care pathway cannot be transposed to trauma. For patients who suffer a hip fracture, FT sectors [21] help to reduce the total LOS without negatively impacting the quality of care.

Disclosure of interest

The authors declare that they have no competing interest.

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Author contributions

1. Mathurin Gomez, primary investigator.
2. Marc Clément, Co-investigator.
3. Talha Abdelhafid, co-investigator.
4. Nicolas Ruiz, helped to write Abstract.
5. Sophie Noublanche, helped to write article, treated patients postoperatively.
6. André Gillibert, biostatistics.
7. Sara Bergman, helped to write abstract.
8. Louis Rony, helped to write article.
9. Vincent Maynard, helped to write article.
10. Laurent Hubert, helped to wrist article.

SOO: helped to write article.

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