

ORIGINAL RESEARCH



# Emergency department access block occupancy predicts delay to surgery in patients with fractured neck of femur

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## Abstract

**Objective:** The present study aimed to identify any relationship between existing access block occupancy (ABO) at the time of patient presentation and delay to definitive procedure.

**Methods:** Retrospective descriptive cohort study of all patients aged over 50 years with an ED diagnosis of fractured neck of femur admitted through a tertiary ED over 2 years. The independent variable was the ABO at the start of the hour in which the patient presented, derived from existing ED records, and expressed as the quartile for that hour of the day. The dependent variable was start of surgery more than 24 h after arrival without a documented reason for delay. The data abstractor was blinded to the ABO.

**Results:** All 442 diagnoses of fractured neck of femur recorded in the ED were reviewed, 73 were excluded (16 age, 5 misdiagnosis, 31 no surgery, 21 documented medical reasons for delay). There was a significant relationship between ABO quartile and the rate of delay to surgery ranging from 54% (95% CI 43–63%) for those presenting in the lowest ABO quartile to 77% (68–85%) in the highest ( $P = 0.006$ ,  $\chi^2$ ). Subgroup analysis showed that arrival ABO predicted patient access block, and that patient access block was associated with delay to surgery and longer postoperative length of stay (geometric mean 12.9 *vs* 9.9 days,  $P < 0.01$ , *t*-test).

**Conclusions:** The number of access block patients at the time of arrival directly predicts delay to operation in this setting. This suggests that access block occupancy is a marker of hospital dysfunction.

**Key words:** *Emergency, overcrowding, access block, fracture, delay.*

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## Introduction

ED overcrowding is a proven risk factor for reduced ED function,<sup>1,2</sup> decreased quality indicators<sup>3,4</sup> and adverse patient outcomes.<sup>5,6</sup> The predominant cause of overcrowding in Australasia is access block,<sup>7,8</sup> the inability of ED patients requiring inpatient admission to access appropriate beds in a timely fashion. An excess of patients in the ED impairs the ability to assess and treat new patients, but it has been suggested that high ED occupancy, particularly with access block patients, reflects a whole-of-hospital dysfunction.<sup>6</sup>

The nationally accepted measure of access block, the proportion of patients admitted, transferred or died with a total ED time of more than 8 h,<sup>9</sup> is by necessity calculated retrospectively over a period of time, usually a minimum of 24 h (presentation patterns vary during the day). Recent literature has suggested that the average occupancy with access block patients ('total access block hours') might be a better predictor of ED function.<sup>10</sup> Neither of these measures clearly represent the state of the ED at any one point in time, and both might include the contribution of patients newly arrived during the period.

The present study sought to assess the point occupancy of an ED with access block patients as a measure of hospital dysfunction, using the care provided to a well-defined group of patients as a quality marker. The primary aim was to identify any relationship between the number of access block patients in the ED at the start of each hour and the time to definitive care of patients presenting with fractured neck of femur during that hour. Secondary aims were to investigate the relationship with other recognized quality of care measures. Fractured neck of femur is a high-risk condition, and an association is reported between delayed surgery and poor outcomes,<sup>11,12</sup> but the relationship is complicated by preexisting illness. Nevertheless, many authorities recommend surgery within 24 h of hospital presentation.<sup>13,14</sup>

## Methods

This was a retrospective descriptive cohort study carried out using chart review and existing data sources at The Canberra Hospital (TCH), Garran, Australian Capital Territory, a tertiary teaching hospital with a mixed ED seeing 52 000 presentations annually. All presentations with a recorded ED diagnosis of fractured neck of femur in calendar years 2006 and 2007 were eligible for chart review. The unit of analysis was the

presentation: it was assumed that separate fractures in separate hips were independent events if they occurred at different times in the same individual. Exclusion criteria on review were: age less than 50 years, misdiagnosis, no surgery and documented medical reason for surgical delay. All chart data were abstracted by one author (KM) blinded to the state of the ED, who recorded the exclusion criteria and the date and time of the definitive surgery from the theatre nurses' report and the anaesthetic sheet.

TCH ED keeps a long-term database of the number of ward inpatient access block patients in the ED (i.e. those being treated who have been in ED more than 8 h and are subsequently admitted to TCH beds, not including discharges from ED, deaths and transfers) derived from the hospital information system. These patients account for the vast majority of access block in this institution. This existing resource was used to derive the ED access block occupancy (ABO, or number of ward inpatient access block patients in the ED) at the start of each hour for the 2 year period.

Second, quartiles for ABO at the start of each hour of the 24 h day were calculated from the 2 year dataset. Subsequently, each 1 h period of the 2 years was classified by quartile according to ABO at the start of the hour. These data were then merged with the abstracted time of surgery and patient/presentation data from the information system for eligible cases.

The time from ED arrival to start of surgery was calculated and classified as 'Timely' if less than 24 h, and 'Delayed' if more than 24 h. The primary hypothesis was that the proportion of delayed surgery would be greater in presentations occurring in higher ABO quartiles. Secondary analysis considered time to start of medical assessment and treatment in the ED, whether the individual patients experienced access block and postoperative length of stay (LOS) in hospital (calculated as a geometric mean because of skew).

Categorical data were compared with the  $\chi^2$  test and continuous variables with the *t*-test, using a threshold of 0.05 for statistical significance. Power calculation showed that a sample size of 366 presentations would have 80% power to detect a difference between 50% and 65% delayed surgery between the lower two quartiles and the upper two quartiles.

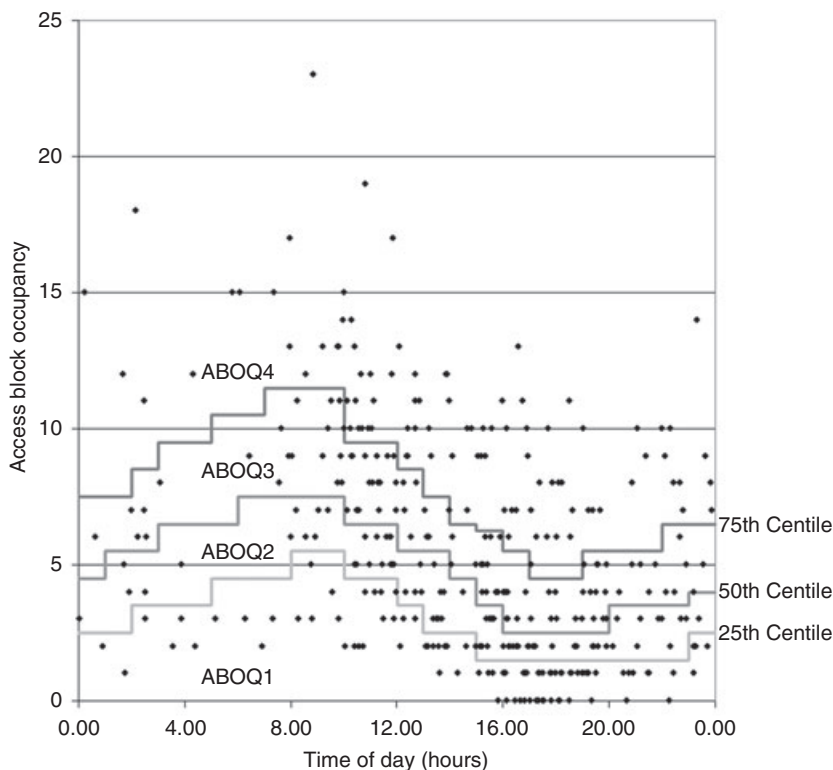
## Results

There were 442 presentations (by 437 different patients) with a recorded ED diagnosis of fractured neck of femur

**Table 1.** Characteristics of sample

	Number	Mean age (years) (95% CI)	Male sex (n, %)
Included	369	80.1 (79.0–81.2)	109 (29.5)
Age <50 years	16	33.7 (27.1–40.3)	12 (75)
Misdiagnosis	5	77.6 (70.4–84.8)	0 (0)
No surgery	31	78.0 (73.7–82.3)	12 (38.7)
Medical delay	21	83.0 (79.1–86.9)	3 (14.3)
Total	442	78.4 (77.1–79.7)	136 (30.7)

*Baseline characteristics of the presentations for which chart review was undertaken. Only the characteristics of the group excluded for age <50 years were statistically significantly different from the population as a whole. ‘Misdiagnosis’ means that the recorded ED diagnosis of fractured neck of femur was incorrect, so neck of femur surgery was not performed.*



**Figure 1.** Time of presentation and access block occupancy (ABO) quartiles (Q). ABO quartiles (lines) for the 2 year period and time of presentation and actual ABO for the 369 cases in the study. The cases were evenly distributed among the quartiles.

in 2 years, with characteristics and exclusions as detailed in Table 1. One hundred per cent of the 369 included charts were reviewed, and no significant change in the average rate of delayed surgery was found over the period of the study. Their times of presentation were evenly distributed among the ABO quartiles (Fig. 1), and there were no significant differences between the four groups demographically (Table 2). Triage (Australasian Triage Scale) was tested because a

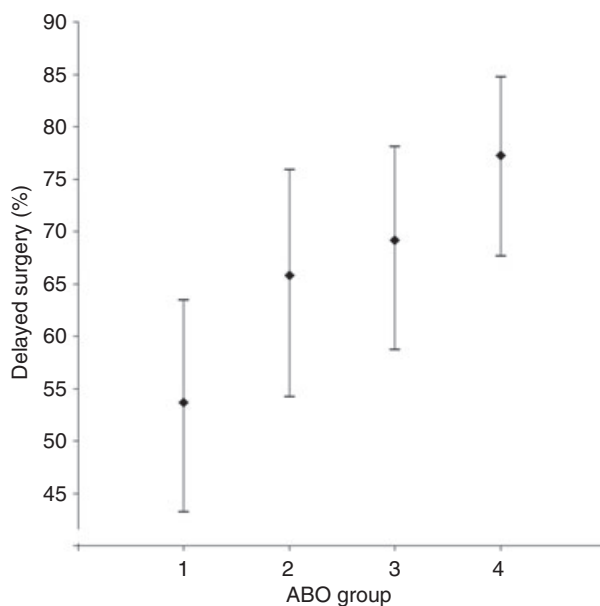
higher triage category implies an intent of shorter waiting time, and presentation times before 16.00 hours were tested because earlier arrival is associated with surgery on the same day. However, the differences in presentation time were not significant ( $P = 0.09, \chi^2$ ), and the direction, if anything, would make presentations in ABO Q1 less likely to have timely surgery.

There was a significant association between ABO quartile at presentation and delayed surgery as shown

**Table 2.** Characteristics by access block occupancy (ABO) quartiles

ABO quartile	Number	Mean age (years) (95% CI)	Male sex (n, %)	Australasian Triage Scale category 3 (n, %)	Present <16.00 hours (n, %)
1	95	80.0 (77.7–82.2)	23 (24)	79 (83)	42 (44)
2	79	80.0 (77.4–82.6)	26 (33)	62 (78)	45 (57)
3	94	81.0 (78.9–83.1)	30 (32)	79 (84)	57 (61)
4	101	79.7 (77.6–81.6)	30 (30)	83 (82)	60 (59)

*Characteristics of the four groups presenting in different ABO quartiles.*



**Figure 2.** Delayed surgery. Proportion ( $\pm 95\%$  CI) of presentations resulting in delayed surgery (>24 h from arrival) by access block occupancy (ABO) group (quartile) at the time of presentation (note expanded scale).

in Figure 2 ( $P = 0.006$ ,  $\chi^2$ ). The relationship between ABO quartile and other markers of quality are shown in Table 3. There was a significant relationship between ABO quartile on arrival and the probability of the patient subsequently experiencing access block ( $P < 0.001$ ). There was no significant relationship between ABO quartile and subsequent postoperative LOS, but postoperative LOS was significantly higher in patients who experienced access block: geometric mean 12.9 versus 9.9 days,  $P = 0.009$ ,  $t$ -test.

## Discussion

In this population, there is a significant increase in the incidence of delayed surgery with increasing ED ABO

immediately before presentation. This is not due to the time of day nor to other recognized confounders, such as patient age and comorbidities.

The primary analysis of time from arrival to surgery does not distinguish between the function or dysfunction of different parts of the hospital system. The secondary analysis shows that ABO quartile on arrival does not predict ED waiting time, although waiting times for fractured neck of femur patients might not reflect ED function overall, as they are a highly select group (100% of presentations in the present study arrived by ambulance). ABO quartile on arrival does predict whether the individual patient will experience access block, so it might be an indication of the state of the inpatient wards rather than the state of the ED.

The present study is consistent with previous work describing a relationship between individual access block and increased LOS,<sup>15,16</sup> but was not designed to indicate the mechanism of this effect. The distribution of LOS is highly skewed, and confounded by the short LOS associated with mortality, so a larger and more detailed study would be required to identify the causes.

The subgroup analysis of other quality indicators suggests that the overall relationship between ABO quartile and hospital function is far from linear. Time spent in the ED ('patient care time') increases most dramatically between the third and fourth quartiles, but the greatest increase in time from leaving the ED to operation is between the first and second quartiles. Indeed, the time from ED to surgery actually decreases at extreme levels of ABO, perhaps because of external reactions, such as cancellation of elective cases, which would make the operating theatres more readily accessible. ABO quartiles represent a useful means of controlling for daily variation, but absolute occupancy figures might provide a more accurate reflection of the situation in ED.

The present study is limited by its retrospective methodology, but certainly provides justification for future prospective studies. The choice of a 24 h threshold from arrival to surgery was arbitrary, and the time

**Table 3.** Process measures by access block occupancy (ABO) quartile

ABO quartile	Access block (%)	Median waiting time (h)	Median patient care time (h)	Median left ED to surgery (h)	Median postoperative LOS (days)
1	46	0:31 (0:14–1:05)	6:39 (4:14–10:19)	17:08 (11:44–35:44)	10 (5–17.5)
2	49	0:37 (0:19–1:33)	6:34 (3:54–13:21)	21:06 (12:13–40:33)	10 (5–23.5)
3	57	0:37 (0:11–1:21)	8:19 (4:08–13:41)	21:09 (11:37–41:18)	10 (7–16)
4	77	0:31 (0:14–1:14)	14:46 (7:37–21:34)	18:27 (8:00–36:24)	10 (6–20)
All	58	0:34 (0:14–1:15)	8:19 (4:42–15:56)	18:42 (10:45–39:22)	10 (6–19)

Standard measures of patient flow<sup>9</sup> by ABO quartile on arrival; figures in brackets are interquartile ranges. Access block is the proportion of patients with total ED Time >8 h, waiting time is the time from arrival to start of assessment and treatment, patient care time from start of assessment/treatment until left ED and LOS is total nights in hospital after surgery (this was highly skewed).

from injury to surgery might represent a better indicator of quality of care, but the time of injury was infrequently recorded in the patient notes.

In terms of patient care, fractured neck of femur is not a condition that improves with conservative management: it is clearly in the interests of hospital function to start the postoperative care as soon as possible. The present study justifies a prospective trial of measures designed to reduce access block.

## Conclusions

The occupancy of the ED with access block patients immediately before the arrival of a patient with fractured neck of femur directly predicts lesser hospital quality of care as defined by the incidence of delay to surgery. ABO might therefore be a useful measure or indicator of hospital dysfunction.

## Competing interests

None declared.

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