Older patients have the most to gain from orthopaedic enhanced recovery programmes

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Abstract

Background: Between August 2007 and May 2009, 2128 consecutive patients underwent either primary hip or knee joint replacement surgery at our institute on an enhanced recovery pathway. We aimed to investigate the potential benefits of this pathway in patients over the age of 85 years.

Methods: Data extracted from Hospital Episode Statistics were analysed. This data are prospectively collected and independently collated.

Results: In all patients median length of stay was reduced when compared with both our own data before the introduction of the pathway (6 to 4 days) and national averages over the same time period for both hip and knee replacements (5 to 4 days). Difference in length of stay was most pronounced in the group of patients aged 85 years and over (9 to 5 days for total hip replacement and 8 to 5 days for total knee replacement). Nearly all patients were discharged directly home (97.4%). Readmission rates were over 45% lower in patients aged 85 and over when compared with national averages (5.2 vs. 9.4%).

Conclusions: This is the first series in the literature to assess the role of enhanced recovery pathways in the very elderly. This study not only shows that successful fast track rehabilitation can be achieved in the very elderly population undergoing elective joint replacement surgery, but that it is this cohort of vulnerable patients who have the most to gain from such multidisciplinary recovery programmes.

Keywords: enhanced, recovery, orthopaedic, elderly, older people

Introduction

The population of the UK is ageing. Over the last 25 years, the number of people aged 85 and over has more than doubled to 1.4 million. Furthermore, it is estimated that by 2035 this figure will reach 3.5 million, with people aged 85 and over accounting for 5% of the total population [1]. With an ageing population comes an increase in demand for joint replacement surgery, especially in this elderly group of patients [2]. However, surgery in this group of patients is associated with increased mortality and morbidity when compared with general populations [3–6]. In addition, there is also an increase in length of stay and a high rate of discharge to extended care facilities. Thus, there is a high-socioeconomic burden. Anything that can be used to reduce the cost to both patients and healthcare services is beneficial.

The use of enhanced recovery pathways (ERP) (also known as ‘fast track’, ‘rapid recovery’ or ‘accelerated recovery’) improves patient care and reduces length of stay in general populations undergoing surgery [7–9]. These pathways focus on optimising every aspect of the patient’s peri-operative management, promoting the patient as an active participant in their own recovery and rehabilitation. Their approach is both multidisciplinary and evidence based, focusing as much on patient education as on surgical and anaesthetic techniques [9]. However, most published series to date focus on younger patient groups whom one would expect to do well anyway [7, 8]. Such selection bias makes it difficult to extrapolate potential benefits to older patients. Yet it is with this vulnerable group of patients where an evidence based, multimodal approach may be the most beneficial.

We aim to be the first unit to investigate the potential benefit of an enhanced recovery pathway in patients over the
age of 85 years undergoing elective joint replacement surgery.

Materials and methods

This is a retrospective cohort study. An ERP was introduced at the Royal Bournemouth Hospital in 2007. An overview of this pathway has previously been described [10] and is summarised in Figure 1. Hospital Episode Statistics data [11, 12] were included for all the patients undergoing elective primary joint arthroplasty for a primary diagnosis of osteoarthritis (OA) on this pathway between August 2007 and May 2009. These data are prospectively collected and independently collated. The following data were analysed: age, sex, index procedure, length of stay (including long length of stay—defined as those who stay beyond the national upper quartile length of stay for their strata of procedure (8 days for 2007 data and 7 days for 2008 and 2009 data), admission type and year of discharge, discharge deposition and readmission rates. Re-admission rate was used as a surrogate marker for morbidity. Using the same search criteria, this dataset was then compared with both a national dataset over the same time period and data from our unit over a similar time frame (October 2005—July 2007) prior to the introduction of our enhanced recovery pathway. The data for those patients aged 85 or over was then analysed independently.

Exclusion criteria from the pathway were cognitive impairment, or medical comorbidities requiring on-going medical supervision during their inpatient stay, or if the surgery was complex in nature. For the purpose of this study bilateral arthroplasties, and hip resurfacings were excluded.

Results

Between August 2007 and May 2009, 2128 consecutive patients underwent primary joint replacement surgery at our institute. Complete datasets were available for all the patients and no patients were lost to follow-up. 883 patients underwent primary hip replacement and 1245 primary knee replacement. There were 752 males and 1376 females with a mean age of 71 years (range 28–93). One hundred and sixteen patients were aged 85 years or older (mean 86 years, range 85–93) with a preponderance of females (72%). Patient demographics are shown in Table 1. It can be seen that patient age, sex distribution and index procedure are similar for all three datasets. Interestingly, hip replacement surgery predominates in patients over the age of 85 compared with knee replacement surgery in patients of all ages.

The median length of stay for patients on the ERP was reduced for all the patients when compared with both the national average length of stay (LOS) and our pre-ERP LOS (Table 1). The observed differences were greatest for those patients aged 85 and over (4 days for hips and 3 days for knees) (Table 1, Figures 2 and 3). The reduction in LOS was observed for both hip and knee replacements when analysed independently and remained when looking purely at post-operative LOS (adjusting for those units that still admit joint replacements the day before surgery).

The greatest reduction was observed in the group of patients aged 85 years or older as having a long length of stay. A 4-fold reduction in the proportion of patients in this group was observed with the use of the ERP (55–14%). Patients over the age of 85 stayed on average an extra day when compared with all the patients on our ERP (5 versus 4 days).

Pre-operative:

- Pre-operative assessment: pre-existing medical conditions identified and optimised (e.g. anaemia, hypertension, ischaemic heart disease)
- Pre-operative education class: helps reduce anxiety and manage expectations
- Discharge planning: begins at the pre-operative assessment clinic

Peri-operative:

- Day of surgery admission with staggered admission and fasting times.
- Single combined dose of cefuroxime and gentamicin at induction for antibiotic prophylaxis.
- Spinal anaesthetic with regional nerve block
- Normothermia maintained with warming blankets
- Surgical approach was not prescribed and varied dependent upon the operating surgeon

Post-operative:

- Standardised analgesic ladder (avoiding opiates where possible)
- Early physiotherapy and mobilisation
- Promotion of independence and wellness.
- Discharge home with appropriate level of support

Figure 1. An overview of our enhanced recovery pathway.
Table 1. Demographics and metrics

<table>
<thead>
<tr>
<th>Dates</th>
<th>Bournemouth</th>
<th>Bournemouth ERP</th>
<th>Rest of England</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>≥85 years</td>
<td>All</td>
</tr>
<tr>
<td>Total joint replacements</td>
<td>2,065</td>
<td>134</td>
<td>2,128</td>
</tr>
<tr>
<td>THR</td>
<td>966</td>
<td>71</td>
<td>883</td>
</tr>
<tr>
<td>TKR</td>
<td>1,099</td>
<td>63</td>
<td>1,245</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>72</td>
<td>87</td>
<td>71</td>
</tr>
<tr>
<td>Range (years)</td>
<td>26–98</td>
<td>85–98</td>
<td>28–93</td>
</tr>
<tr>
<td>Male</td>
<td>740</td>
<td>38</td>
<td>752</td>
</tr>
<tr>
<td>Female</td>
<td>1,325</td>
<td>96</td>
<td>1,376</td>
</tr>
<tr>
<td>% Male</td>
<td>36</td>
<td>28</td>
<td>35</td>
</tr>
<tr>
<td>Discharged home</td>
<td>2,028</td>
<td>123</td>
<td>2,119</td>
</tr>
<tr>
<td>% discharged home</td>
<td>95.3</td>
<td>91.8</td>
<td>99.6</td>
</tr>
<tr>
<td>Median length of stay—THR</td>
<td>6</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Median length of stay—TKR</td>
<td>6</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Long length of stay (binomial confidence intervals)</td>
<td>412</td>
<td>73</td>
<td>94</td>
</tr>
<tr>
<td>% Long length of stay</td>
<td>20.0% (18.3–21.7%)</td>
<td>54.5% (46.3–62.7%)</td>
<td>4.4% (3.6–5.3%)</td>
</tr>
<tr>
<td>Emergency readmissions (30-day)</td>
<td>114</td>
<td>8</td>
<td>101</td>
</tr>
<tr>
<td>% readmissions (binomial confidence intervals)</td>
<td>5.5% (4.6–6.5%)</td>
<td>6.0% (2.2–10.4%)</td>
<td>4.7% (3.9–5.7%)</td>
</tr>
<tr>
<td>30-day mortality</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mortality rate (%)</td>
<td>0.1% (0.0–0.2%)</td>
<td>0.0% (0.0–0.0%)</td>
<td>0.0% (0.0–0.0%)</td>
</tr>
</tbody>
</table>

99.6% of our patients were discharged directly home (i.e. their usual place of residence) with only 0.4% requiring additional inpatient rehabilitation. In those patients 85 and over 97% were discharged directly home compared with only 84% nationally.

Our readmission rate was 4.7% for all the patients. This is comparable with both national averages (6.2%) and those in our unit prior to the ERP (5.5%). Interestingly, the readmission rate for the very elderly was over 45% lower in our group compared with national averages (5.2 versus 9.4%). There were no deaths within 30 days in our ERP group compared with a 30-day mortality of 0.2% nationally and 0.1% prior to the ERP. In patients aged 85 and over our mortality rate was 0% compared with a national average of 0.8%.

**Discussion**

This study not only shows that successful fast track rehabilitation can be achieved in older patients undergoing elective joint replacement surgery but that it is this cohort of patients who have the most to gain from such multidisciplinary recovery programmes. Not only did we observe a clinically significant reduction in length of stay in patients aged 85 and over on our ERP without a detrimental effect on morbidity and mortality but we also observed a reduction in readmissions in this vulnerable group of patients. Applying the reduction in LOS observed in our older patient cohort to the national dataset would have saved 30,202 bed days or £7,550,500 (at an estimated bed day cost of £250) over the study period. This represents a significant saving to the NHS at a time of austerity. In addition to a reduction in median LOS, the variation around the median is also greatly reduced thus enabling the more effective planning of elective services and further cost reduction.

The use of enhanced recovery techniques was originally described in colorectal surgery but their use has spread to other surgical specialities including orthopaedics [9]. While the benefits of such enhanced recovery pathways are well established, little is known about their potential impact on older patients. This is the first study to date to look specifically at the role of enhanced recovery pathways in orthopaedic patients over the age of 85. The strengths of this study are the prospective nature of the data collection, the large sample size and a complete dataset along with rigorous audit of the whole process. In addition, compared with many other studies showing the benefits of enhanced recovery pathways in young, slim healthy males where there is a clear selection bias, we had few exclusion criteria [7, 8]. Patients were excluded if they had cognitive impairment, American Society of Anesthesiologists (ASA) 4 or with medical comorbidities requiring on-going medical supervision during their inpatient stay, or if the surgery was complex in nature. By limiting our search criteria to patients undergoing elective surgery for a primary diagnosis of OA, we are automatically excluding patients who are ASA 4 from all datasets as they are not suitable for elective surgery. Thus we have tried to match our datasets as much as possible.
However, the main weakness of our study is the fact that it is not a randomised controlled trial. The dataset is therefore still susceptible to a degree of selection bias. However, the fact that our observations are clearly seen in the data from both our unit prior to the introduction of the ERP and nationally over the same study period goes some way to addressing this issue. In addition, the patient demographics for all three groups are similar.

Another weakness of our study lies with the fact that some centres were also using their own enhanced recovery programmes during the study period [12]. These are included in the national dataset as we had no way of eliminating them. However, if we had of been able to exclude these units then the differences we observed would probably have been even greater.

Joint replacement surgery in octogenarians and nonagenarians has been shown to be associated with an increase in both morbidity and mortality along with inpatient stay and the need for further rehabilitation when compared with average patient populations [3–6]. Similar trends were observed in our study. These observations are explained by both the reduction in physiological reserves that occur with age and the increase in pre-existing medical conditions, especially cardiovascular and pulmonary disease [13].

The benefits in the older patient cohort observed in our study are multifactorial, and we believe are as a result of an evidenced based, multidisciplinary approach to all aspects of the patient’s peri-operative care. There is emerging evidence to suggest that the use of ERPs reduces death rates for all the patients undergoing joint replacement surgery [12]. While we have observed a similar trend, especially in >85 s, the relatively small numbers in our dataset means that these data must be interpreted with caution.

As previously stated, our ERP begins with the first pre-operative assessment visit (Figure 1). At this first visit, we aim

**Figure 2.** Length of stay box plots for patients over 85 years undergoing THR. Boxplots show the median and inter-quartile range of the data with whiskers extending to a maximum of 2.5× inter-quartile range. (a) Bournemouth versus rest of England. (b) Bournemouth versus rest of England post op LOS only. (c) Bournemouth pre- and post-ERP.
to identify and treat/optimise any correctable pre-existing medical conditions (e.g. anaemia, ischaemic heart disease, etc.).

There is an increased prevalence of anaemia in older patients with rates of up to 8.5% being reported [14]. Pre-operative anaemia has been shown to be associated with an increase in mortality and transfusion requirements [15, 16]. The identification and correction of anaemia pre-operatively is important. It has been shown to reduce the risk of blood transfusion post-operatively, which is associated with both increased inpatient stay and increased peri-operative risk including infection. This is particularly important in older patients, as transfusion rates of up to 71% have been reported [4]. The pre-operative assessment visit also allows optimisation of other pre-existing medical conditions in order to reduce the chance of cancellation on the day of surgery and plays an important role in patient education.

The effective education of patients and their relatives pre-operatively is important. We believe this is one of the fundamental aspects of enhanced recovery programmes. The management of patient expectations through effective education plays an important part in helping reduce inpatient stay, improve outcomes and may also reduce patient anxiety [17–19]. In addition to managing patient expectations, it is important to commence discharge planning at the pre-assessment stage. The literature reports high rates of discharge to extended care facilities in the octogenarians and non-agenarians [6]. This is supported by our own dataset where only 84% of patients nationally were discharged directly back to the place of residence following surgery. However, as a result of a structured, evidence-based approach, almost all our patients were discharged home with a support package tailored to their individual needs. It is important to emphasise that no additional support was needed from primary care setting as our criteria for discharge (i.e. the discharge assessment criteria used by the physiotherapists and occupational therapists) was not altered.

Figure 3. Length of stay box plots for patients over the age of 85 undergoing TKR. Boxplots show the median and inter-quartile range of the data with whiskers extending to a maximum of 2.5× inter-quartile range. (a) Bournemouth versus rest of England. (b) Bournemouth versus rest of England post op LOS only. (c) Bournemouth pre- and post-ERP.
The use of same day admission with staggered admission times enables optimum management of patient fasting times thus ensuring patients have good levels of hydration and energy prior to surgery. This is of particular importance in older patients as both poor nutritional status and impaired renal function are common [13]. In addition, they have an increased tendency to develop dehydration and electrolyte imbalance. Thus, careful fluid management and blood pressure control is of utmost importance in the peri-operative period to reduce the incidence of post-operative renal failure. While not routinely used as part of our enhanced recovery pathway carbohydrate loading drinks 2–3 h pre-operatively may also be beneficial, especially in patients starting with poor nutritional status [20].

The majority of peri-operative complications in the octogenarians and non-agenarians are medical [4–6]. Regional anaesthesia has been shown to result in a reduced risk of deep vein thrombosis, pulmonary embolus, myocardial infarction, pneumonia and delirium [21–24]. By using a standardised anaesthetic protocol (spinal anaesthetic with regional block +/- sedation), we avoid the risks of general anaesthesia in this vulnerable group of patients. Further benefits are achieved with the use of a standardised analgesic ladder post-operatively as good pain control not only reduces cardiopulmonary complications [13], but also allows early mobilisation. A structured approach also helps to avoid excessive or inappropriate opiate use thus also reducing opiate-related side effects and aiding early mobilisation.

Minimising physiological disturbance to the patient in the peri-operative period allows effective early mobilisation of the patients, re-emphasises a feeling of wellbeing and also helps reduce post-operative morbidity. In our pathway, the role of the physiotherapist is extremely important. Not only do patients benefit from twice daily visits, but the average time to first mobilisation is <8 h [10]. It is this intensive physiotherapy that enables earlier discharge in this group of patients in the absence of post-operative complications.

In conclusion, the use of enhanced recovery pathways benefits patients over the age of 85 the most. A standardised, evidence-based approach facilitates earlier discharge home with reduced requirements for extended care facilities. This is of great benefit to both the patients and healthcare services. However, the authors propose that in order to further address the potential reduction in mortality and morbidity offered by enhanced recovery pathways, a randomised controlled trial should be undertaken.

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**Key points**

- Reduced length of stay;
- Most pronounced in the very elderly;
- Evidence based.

**References**


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Abstract

Background: age-related issues are expected to rise in the coming decades. Osteoporosis, falls and fractures are major public health issues among elderly. Pelvic fractures are associated with a serious morbidity and hospitalisation rate. We therefore performed a study to determine trends in incidence and age-specific rates of pelvic fracture-related hospitalisations among elderly (≥65 years).


Results: the total number of hospitalisations due to a pelvic fracture increased from 887 in 1986 to 2,013 admissions in 2011 (127% increase). The overall age-adjusted incidence rate increased from 5.19 in 1986 to 7.14 per 10,000 population in 2011 (37.5% increase). The incidence rate increased with age and was higher for females. The Percentual Annual Change was 1.2% (95% CI: 0.9;1.5) for older males, and 1.0% (95% CI: 0.9;1.2) for females, respectively. The mean length of hospital stay decreased between 1991 and 2011 to 12.0 days (53.4% decrease). The total number of hospital-bed-days decreased from 29,002 days in 1991 to 17,283 days in 2011 (40.4% decrease), despite an increase in absolute number of admissions.

Conclusion: absolute numbers and incidence rates of pelvic fractures are increasing among the older Dutch population. Considering the fact the general population is growing older, an increasing number of elderly suffer from pelvic fractures. Attention on osteoporosis screening and prevention of falls in elderly remains important, in order to limit-related healthcare costs in the future.

Keywords: trends, falls, pelvic fractures, The Netherlands, older adults, older people