A quantification of discharge readiness after outpatient anaesthesia: patients’ vs nurses’ assessment

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Abstract

Objectives: Criteria for discharge after outpatient surgery do not take into consideration the patients’ assessment of discharge readiness. Our aim was to compare discharge readiness as determined by nurses with that determined by patients against the modified Aldrete score as a benchmark. Design and setting: In this prospective study, a single observer followed 194 outpatients in the PACU. A modified Aldrete score was assigned and further assessments were made at 15-min intervals in parallel with those made by nursing staff. Nurses and patients were blinded to each other’s assessments. Discharge readiness was quantified according to three different approaches: 1) time to reach a modified Aldrete score of >9, 2) time to discharge readiness according to the patient’s own evaluation and, 3) time to discharge readiness according to nursing assessments. Results: All three times were significantly different from each other. a) Time to achieve a modified Aldrete score >9 was 8.3+7.6 min, b) Time the patient felt discharge ready was 45.3+39.5 min, c) Time the patient was actually discharged by nurses was 86.8+45.8 min. Conclusions: Nursing staff tend to keep patients an additional 41.5 + 36.6 min in the PACU compared to the patients’ own evaluation. Significant cost saving could be potentially realised if outpatients who achieve a modified Aldrete score >9 are allowed some freedom in the determination of their own discharge readiness.

INTRODUCTION

The question of appropriate length of stay in a surgical facility after outpatient anaesthesia and surgery is crucial to the future growth of ambulatory surgery. In many units, a postanaesthesia recovery score (for example, a modified Aldrete score) is determined in Phase I PACU. When the patients attain a score of > 9, they are transferred to Phase II. Discharge home from Phase II is based on clinical discharge criteria which require the patient to be clinically stable but also take into consideration factors such as the availability of an adult escort, ability to understand postoperative instructions, ability to tolerate oral fluids, to void and walk unassisted. Neither Phase I nor Phase II discharge criteria take into consideration the opinion of the patient. Recently, it has been

Appendix 1

Modified Aldrete Score

<table>
<thead>
<tr>
<th>Level of Consciousness</th>
<th>Activity</th>
<th>Respiration</th>
<th>Circulation</th>
<th>Saturation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Fully awake, orientated in place and time</td>
<td>2 Moving all four limbs on command</td>
<td>2 Breaths and coughs well</td>
<td>2 BP +/- 20% of pre-anaesthetic value</td>
<td>2 SpO2 &gt; 92% on room air</td>
</tr>
<tr>
<td>1 Rousable on calling name</td>
<td>1 Moving two limbs spontaneously</td>
<td>1 Dyspnoea or tachypnoea</td>
<td>1 BP +/- 20 – 49% of pre-anaesthetic value</td>
<td>1 O2 required to keep SpO2 at 90%</td>
</tr>
<tr>
<td>0 Not responding</td>
<td>0 Not moving at all</td>
<td>0 Apnoea</td>
<td>0 BP +/- 50% of pre-anaesthetic value</td>
<td>0 SpO2 &lt; 90% with O2</td>
</tr>
</tbody>
</table>

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shown that after outpatient laparoscopic cholecystectomy, there was disagreement between patients and nurses - a majority of patients felt they were not home ready while nursing staff held the opposite view. There is little information on how patients' assessment of discharge readiness compares with nurses' assessments of discharge readiness after other types of outpatient procedures.

The aim of this study was to compare discharge readiness as determined by nurses with that determined by patients against the modified Aldrete score as a benchmark.

**METHODS**

The study was conducted in the Surgical Day Care Centre (SDCC) at Vancouver General Hospital, an 800-bed tertiary-care academic hospital. Approximately 8-10,000 outpatient anaesthetics are performed in our SDCC per annum. The SDCC facility consists of four operating rooms performing procedures that represent most day care surgical specialities. The PACU consists of a Phase I and Phase II area. At our institution, in order to discharge patients from Phase I, nurses use the following clinical criteria:

- a) completely alert and oriented;
- b) stable vital signs within 20% of preoperative values;
- c) no surgical complications;
- d) absence of side effects such as nausea, vomiting and dizziness; e) adequate pain control with oral analgesics;
- f) resolution of sensory and motor block after neuraxial anaesthesia, and
- g) able to walk.

Patients leaving our Phase I area are considered home-ready.

Our Phase 2 PACU is a lounge area where patients await a ride home or final instructions.

It is not an area to which our patients have been fast-tracked to date, unlike in other North American Institutions. Input from anaesthesiologists is not a requirement for discharge home unless the attending staff specifically requests this. In the PACU, patients were monitored as per established protocols. Assessments of pain and nausea/vomiting were performed by the nurses according to the standard of care in the PACU. Rescue analgesia and anti-emet therapy was administered at any time at the request of the patient or physician. The choice of analgesics and anti-emetic was left to the discretion of the attending anaesthesiologist.

Discharge time determined by nurses in this study refers to the total time in Phase I. Once patients leave the Phase I area, they are transferred to a Phase II area. Discharge home from the Phase II area is dependent on multiple factors such as availability of transport, escort etc and is therefore not suitable for precise quantitative analysis. The institutional ethics committee approved the study and individual patient consent was not required. All patients and nurses were blinded to the goals of the study.

Patients were tracked through the SDCC over consecutive days. Only one physician observer (KC) was involved in the evaluation of patient recovery and discharge time for this study. On each day, the patient observation period started with the first patient admitted to the PACU each morning and ended with the last patient discharged at the end of each day. The observer filled out a data sheet for each patient that was admitted to the PACU. For each patient tracked in the study, the following information was obtained: patient’s hospital ID number, age, gender, ASA score, race, surgical service, surgical procedure and anaesthetic technique. Immediately upon each patient reaching the PACU, the admission time was noted and a modified Aldrete score assigned by the observer. Each patient was then evaluated at 15-min intervals in parallel with nursing assessments until the patient was discharged from Phase I. At each assessment, the observer documented the modified Aldrete score, the nurses’ assessment of discharge readiness, and the patients’ assessment of discharge readiness. Both the patient and nursing staff were queried at each 15-min period regarding whether the patient was ready for discharge. Nurses and patients were blinded to the modified Aldrete score and each other’s assessments with respect to discharge readiness.

Groupings for anaesthetic technique were:

1) regional
2) general with facemask or laryngeal mask airway (GA-LMA/Mask)
3) general endotracheal anaesthetic (GA-ETT)
4) local
5) other.

General anesthetic techniques used in these patients were:

- a) induction – propofol,
- b) maintenance – sevoflurane, isoflurane or propofol with oxygen and nitrous oxide,
- c) relaxants – mivacurium, atracurium or rocuronium,
- d) analgesics – fentanyl or alfentanil,
- e) reversal agents – glycopyrrolate and edrophonium or neostigmine.

Duration of anesthesia and surgery was not assessed in relation to discharge time in this study.

A standardized data collection form was used for each patient. Data was entered into a spreadsheet program. Statistical analysis was performed with the Statistical Analysis Software system. Data are expressed as means ± SD and paired sample statistics and, single factor ANOVA were used to identify significant differences. A P value of < 0.05 was considered significant.

**RESULTS**

A total of 194 patients was enrolled in the study. The demographics of the study population are summarised in Table I. The mean age was 41±18yr (Range 14-92 years). The modified Aldrete scores on arrival in PACU are summarised in
Table I. Demographics

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male/ Female</td>
<td>69/125</td>
<td>36/64</td>
</tr>
<tr>
<td>Ethnicity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>132</td>
<td>68</td>
</tr>
<tr>
<td>Asian</td>
<td>48</td>
<td>24.7</td>
</tr>
<tr>
<td>African-American</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>5.1</td>
</tr>
<tr>
<td>ASA Class: I/II/III</td>
<td>121/59/14</td>
<td>62/30/7</td>
</tr>
<tr>
<td>Anaesthetic Technique:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General (LMA/FM)</td>
<td>93</td>
<td>48</td>
</tr>
<tr>
<td>General (ETT)</td>
<td>64</td>
<td>33</td>
</tr>
<tr>
<td>Local</td>
<td>31</td>
<td>16</td>
</tr>
<tr>
<td>Regional</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>Surgical Speciality:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gynaecology</td>
<td>73</td>
<td>37</td>
</tr>
<tr>
<td>Urology</td>
<td>52</td>
<td>27</td>
</tr>
<tr>
<td>ENT</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Dental</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>9</td>
<td>4.6</td>
</tr>
<tr>
<td>General Surgery</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Vascular Surgery</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Plastics</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 1. Modified Aldrete Scores on arrival in PACU

Table II. Summary for various times

<table>
<thead>
<tr>
<th></th>
<th>Mean + SD (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to achieve modified Aldrete &gt;9 (A)</td>
<td>8.3 + 7.6</td>
</tr>
<tr>
<td>Time patients felt discharge ready (B)</td>
<td>45.3 + 39.5*</td>
</tr>
<tr>
<td>Time nurses discharged the patients (C)</td>
<td>88.8 + 45.8*</td>
</tr>
<tr>
<td>B minus A</td>
<td>36.9 + 39.2**</td>
</tr>
<tr>
<td>C minus B</td>
<td>41.5 + 36.6**</td>
</tr>
</tbody>
</table>

*P < 0.001  ** P < 0.0001

Table III. Mean differences in time patient discharged minus time patient felt ready for discharge by subgroup.

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Mean + SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA-ETT</td>
<td>44.5 + 41.3</td>
<td></td>
</tr>
<tr>
<td>GA- LMA/Mask</td>
<td>35.4 + 30.3</td>
<td></td>
</tr>
<tr>
<td>Other regional</td>
<td>37.5 + 25.9</td>
<td>0.063</td>
</tr>
<tr>
<td>ENT surgery</td>
<td>38.1 + 26.8</td>
<td></td>
</tr>
<tr>
<td>Urology surgery</td>
<td>39.2 + 39</td>
<td></td>
</tr>
<tr>
<td>Gynaecology surgery</td>
<td>36.1 + 30</td>
<td></td>
</tr>
<tr>
<td>ASA Class I</td>
<td>39.5 + 30.8</td>
<td></td>
</tr>
<tr>
<td>ASA Class II</td>
<td>37.3 + 33.7</td>
<td></td>
</tr>
<tr>
<td>ASA Class III</td>
<td>76 + 68.7</td>
<td>0.001</td>
</tr>
</tbody>
</table>

DISCUSSION

This study has demonstrated that actual discharge time after outpatient surgery (86.8 + 45.8 min) was significantly longer than the time that patients felt discharge ready (45.3 + 39.5 min), which in turn was significantly longer than discharge readiness time assessed by objective criteria such as the modified Aldrete score (8.3 + 7.6). These differences were still present when subgroup analysis by anaesthetic type, surgery type and ASA score were performed. The total extra time (de-
fined as the time that the patient was discharged minus the
time that the patient felt discharge ready) spent in PACU for
the seven days of the study was found to be 134 ± 118 hr.

Modern anaesthetic agents such as propofol, desflurane and
sevoflurane have been shown to be associated with such a
rapid recovery that patients have achieved a modified Aldrete
score of > 9 within 10 to 15 min of termination of anesthe-
sia.3 On arrival in the PACU, 75% and 90% of patients man-
aged with sevoflurane and desflurane respectively were found
to be fast-track eligible compared with 26% of patients re-
ceiving propofol.3 Our results were comparable to these be-
cause the time to achieve a modified Aldrete score of >9 in
the present study was 8.3 ± 7.6 min. This time does not in-
clude the time to transfer the patient from the operating room
to the PACU. In addition, 22% and 25% of our patients had a
modified Aldrete score of 9 and 10 respectively on arrival in
PACU. Thus, a total of 47% of our patients were fast-track
eligible. This lower fast-track eligibility reflects the variety
of anaesthetics used in our SDCC.

It has been demonstrated that >20% of patients experi-
enced a delayed PACU discharge accounting for 8% of total
PACU time.5 Delayed discharge was defined as a patient be-
ing discharged >30 min after a physician determined that dis-
charge was medically appropriate. Causes of discharge de-
lays were administrative or non-medical factors. The present
study was not designed to examine reasons for delayed dis-
charge in our day-care unit. However, the investigators were
absolutely assured that none of the delays were due to medi-
cal reasons. The fact that all patients in this study were ex-
posed to delays when compared to an objective standard
(Modified Aldrete score) and to the patients’ own assessment
suggests that greater scrutiny needs to be directed at deci-
son-making by nurses.

Since patients are delayed by approximately 41 min (Table
2), our unit could achieve substantial cost savings per year
based on a census of 10,000 annual cases, if patients were
discharged when they felt ready. Such a large potential for
cost savings suggests that a prospective study, allowing pa-
ients freedom to determine their own discharge times, needs
to be considered. However, reducing length of stay alone is
not enough to substantially reduce cost. The peak levels of
patients numbers in the PACU needs to be reduced by 25%
before staffing levels may be reduced and therefore signifi-
cant savings be realised.6

Optimizing patient turnover in the PACU may lead to less
disruption in operating room schedules because if the admis-
sion rate to the PACU is higher than the discharge rate, the
result is that the operating room is held up.6

One of the single most important factors in patient delay
postoperatively is the subjectivity associated with nursing
decision making.5

There may be concerns that patients may not be good judges
of their own discharge readiness and that nursing staff may
adopt a more cautious and hence, safer approach to determi-
nation of discharge. However, the reverse appears to be the
case. Fleisher et al have demonstrated that after outpatient
laparoscopic cholecystectomy, only 29% of patients felt they
were ready to be discharged home compared with 79% that
were felt by nursing staff to be acceptable for home discharge.6
It seems that the determinants of patient’s assessment of dis-
charge readiness appear to take into consideration factors in
the home environment that are beyond the purview of nurses
but which are nevertheless of considerable importance from
the safety perspective.

There may be a perception that a longer stay in the PACU
would be essential in order to identify complications such as
surgical bleeding. Whereas minimum times of observation in
the PACU have been defined arbitrarily to detect complica-
tions such as bleeding after procedures such as tonsillectomy,
there is little objective data to support such empirical guide-
lines.7 On the contrary, bleeding is a complication that occurs
on a continuum from the end of surgery over several day of
the ensuing postoperative period depending on the type of
surgery.6,7,8 Most patients at risk of postoperative bleeding can
be identified by observation in the PACU for 30 - 45 min.8
Increasing the PACU observation period beyond this would
increase the yield at the expense of decreased efficiency of
the PACU.8 Any patient at high risk of a postoperative com-
plication as determined by a physician will clearly warrant a
more conservative approach in planning their discharge. Pa-
tient education prior to discharge including the distribution
of information sheets with detailed instructions should any
untoward effects occur at home, are paramount in any dis-
charge policy in ambulatory units.

Prevention of minor complications such as postoperative
nausea and vomiting (PONV) may be another reason for de-
laying a patient’s discharge from PACU. In this study, we did
not assess complication rates or timing of postoperative
events. Indeed, there is no assurance that a patient who has
remained symptom free in the PACU will remain so after dis-
charge. This problem was illustrated in a study by Michaloliakou et al.9 Outpatients were randomised to receive
either multimodal analgesia (treatment group) or single mo-
dality analgesia (controls) and both groups received droperidol
at induction. In the PACU, the incidence of PONV was 4.7% in
the treatment group and 29.7% in the control group. How-
ever, following discharge from the PACU, the incidence of
PONV was high and similar in both groups (treatment 23.8%,
control 33.8%). The cumulative probability of being compli-
cation (PONV) free, decreases over time after surgery.9 This
type of behaviour may also apply to other complications seen
after outpatient surgery.7,8

The medico-legal implications of allowing patients to de-
termine their own discharge should not deter the formulation
of new and safe discharge guidelines. Some parallels may be
worthwhile considering. Fasting guidelines in outpatients have
been changed in many institutions from ‘NPO after midnight’
to ‘clear fluids up to 3 hr before surgery’ – in this case pa-
tients have been given more autonomy over their preoperative intake without distraction from medico-legal considerations. Such a change in practice has been found to be safe and beneficial to patients.

There are some design aspects of this study that also need to be considered. Sampling bias\(^9\) could have occurred because it was not possible to track all patients admitted to the PACU and only 5 patients could be tracked consecutively due to the constraints of having to closely follow each one. However, the demographic, surgical and anaesthetic diversity suggest that a wide cohort was sampled and it was representative of our day unit. The exclusion of some patients was based on whether the investigator was able to follow them closely and did not coincide with times when the PACU was busy. Exclusion of some of these patients may have introduced some errors in the correct estimation of discharge readiness. Bias could also have occurred in the determination of discharge readiness by the anaesthesiologist. A gold standard (Modified Aldrete score) was utilised to minimise error from subjective assessments. The Aldrete score may no longer be the objective score of choice as it disregards postoperative complications such as bleeding, postoperative nausea and pain. It is a suitable scoring system to determine bypassing Phase 1 in an institution where fast-tracking is undertaken. An alternative scoring system might have been better employed. However, a single anaesthesiologist was used for all assessments of the modified Aldrete score to minimise inter-observer error. Our inability to blind the anaesthesiologist may still leave room for observer bias based on the patient’s condition, type of surgery and anaesthetic. However, it is difficult to determine if a study where the anaesthesiologist was blinded would yield additional useful information because the determination of discharge readiness requires knowledge of the patients’ comorbid status, type of surgery and anaesthetic. With respect to nursing assessments, there was less room for bias because the nursing staff were unaware of the Aldrete scores or the patients’ assessments. Similarly, the patients were blinded to the Aldrete scores and the assessments made by nurses.

The population studied was from that of a large academic centre. Some of our patients may therefore be unique in terms of physical condition and type or extent of surgery. However, the demographics suggest that our patients and hence our findings are comparable to other centres.

In conclusion, it was found that when patients determined their own discharge readiness, the time they felt discharge-ready was significantly shorter than the actual time they were discharged based on nursing assessments. In the light of these findings, we suggest that perhaps the patients’ subjective input into their own discharge should also be considered as well the subjective nursing discharge criteria which are commonly employed. The considerable economic consequences of the discrepancy demonstrated suggest a prospective multicenter study is warranted before any changes in discharge policy are made.

References
6. Dexter F, Tinker JH. Analysis of strategies to decrease post anesthetic care unit costs. Anesthesiology 1995; 82:1534-1535