

## Why are ambulatory surgical patients admitted to hospital? Prospective study

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### Abstract

**Background:** Once Ambulatory Surgery (AS) has been demonstrated to be an effective alternative to hospitalisation for many surgical patients, it is necessary to establish clinical indicators to evaluate objectively the quality of care that is being given. **Hypothesis:** The unplanned admission index (UAI) is a valid and easy indicator of the management and quality of care in ambulatory surgery units. **Design:** Prospective study. **Setting:** Public regional hospital level I (less than 200 beds). **Main outcome measure:** Unplanned admission index (UAI). **Patients and methods:** Between September 1997 and October 2000, 3502 patients were operated on in our ambulatory surgery unit. The analysed surgical services were General surgery (844 patients), Orthopaedics (646 patients), Urology (499 patients), ENT (329 patients), Ophthalmology (1007 patients) and Gynaecology (177 patients). A prospective study of all the patients was made, with analysis of the following parameters: (1) global and accumulated UAI (per months and years); (2) UAI by surgical specialities; (3) UAI by causes; (4) UAI by type of operation; (5) UAI by type of anaesthesia; (6) case-mix, according to average weight of diagnostic related groups classification (DGR). **Results:** The global UAI was 4.1%. By specialities, the UAI was 10.7% in Gynaecology; 6.1% in ENT; 5.9% in General surgery; 3.4% in Orthopaedics; 2.3% in Ophthalmology and 2% in Urology. The most frequent causes of unplanned admission were haemorrhage: 15.9%; more extensive surgery than anticipated: 15.3%; postoperative pain: 12.5%; nausea and vomiting: 10.4%; and drowsiness and dizziness: 6.9%. The types of operation with the highest UAI were, gynaecological laparoscopy: 50%; hysteroscopy: 26%; haemorrhoidectomy: 25%; septoplasty: 22%; strabismus surgery: 11%; orchiopexy: 11%; hydrocelectomy: 10%; inguinal hernia repair: 8%. **Conclusions:** (1) Classification of UAI by specific causes of admission and incorrect selection of patients may detect on-line problems and allow the application of concrete solutions to reduce the UAI index. (2) In order to compare the results amongst different ambulatory surgery units, an international classification of ambulatory patients must be applied. In the same way, an objective index to evaluate the surgical complexity and the patients' morbidity should be developed. (3) The assessment of processes and results should be based on the selection of standard indicators with systematic and periodic measurement. © 2002 Elsevier Science B.V. All rights reserved.

**Keywords:** Ambulatory surgery units; Patients; Unplanned ambulatory surgery (UAI)

### 1. Introduction

Ambulatory surgery (AS) has been introduced as the ideal treatment for a large number of surgical patients. It is necessary to establish objective clinical indicators to compare the results obtained by different units and hospitals in order to improve the quality of care. The unplanned admission index (UAI) index is an objective

indicator, simple and easy to measure, that at least partly allows, the assessment of the quality of an ambulatory surgery program. A very interesting aspect of UAI as a quality indicator is the possibility to localise and point out problems that can be rapidly improved. For this reason, this indicator has been addressed as the most important in ambulatory surgery [1,2].

#### 1.1. Aim of the study

An analysis of UAI by causes, surgical specialities and types of operations. Studied in a prospective way,

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it allows on-line detection and correction of problems and errors at preoperative evaluation, and also better postoperative management of ambulatory patients. In this way, the UAI may be reduced thus improving the use of resources and patient satisfaction.

An unsettled subject is the objective evaluation of the complexity level of our ambulatory surgery units. This complexity must include not only the technical difficulty but patients associated co-morbidity as well. Without this data, the most important quality indicators in ambulatory surgery, as the UAI or those related to the financing, will not be able to be used suitably.

## 2. Patients and methods

### 2.1. Facilities

Between September 1997 and October 2000, 3502 patients were operated in the ambulatory surgery unit. The unit can be defined as an *Integrated Mixed Ambulatory Surgery Unit*; it shares the admission area, operating rooms and postoperative anaesthesia care unit, while there is a specific area reserved for the final recovery before patients are discharged. Our hospital is defined as a level-I regional centre (less than 200 beds), which covers a population of 120,000 habitants.

Surgical procedures were classified according to ICD.9.CM (International Classification of Diseases Procedure Code) and afterwards grouped by DGR (Diagnostic Group Related) system.

### 2.2. Main outcome measure

The main variable studied was the UAI, which is defined as ‘*overnight stay in the hospital of patients scheduled as ambulatory surgery due to any medical, surgical or social reason*’.

### 2.3. Anaesthetic evaluation

All patients were given written preoperative information about ambulatory surgery. An informed consent signed by the surgeon, anaesthesiologist and the patient was necessary to be scheduled for surgery. Preoperative anaesthetic evaluation was made according to a defined protocol of selected tests. ASA-I patients (American Society of Anaesthesia) were not evaluated in the anaesthesia office, while patients ASA-II and -III were all evaluated.

Operations were performed under monitored local anaesthesia (1757 patients), regional anaesthesia (1136 patients), or general anaesthesia (609 patients).

### 2.4. Postoperative follow-up

Prior to discharge all patients received written instructions, a date for clinical office follow-up for 4–7 days postoperatively and a help line telephone number. Our hospital is the only public center on the island. That is why, all phone calls, emergency consultations and unplanned admissions can be adequately registered.

A telephone call was made to every patient on the 1st and 3rd postoperative days when a specific check form questionnaire was completed.

### 2.5. Studied variables

Data collection was fulfilled prospectively by a trained nurse and supervised by the same surgeon. Variables studied in the present work were:

- Global rate of unanticipated admission index.
- UAI rate by surgical specialities.
- Causes of admissions.
- Admissions related to the type of procedure.
- Admissions related to the type of anaesthesia.
- Average case-mix of the surgical units.

Unanticipated admissions were classified into two general groups:

- (I) Admissions due to specific complications, and
- (II) Admissions caused by incorrect selection of patients for ambulatory surgery (AS).

All admissions were documented in a predefined check form specifying the cause of admission, surgical speciality, preoperative diagnosis, type of anaesthesia, surgical operation and the name of the responsible surgeon.

### 2.6. Definitions

#### 2.6.1. More extensive surgery

This item was defined as patients that had to overnight in the hospital because the indication for surgery was considered in the operation room to be non-suitable for ambulatory surgery, because an extensive dissection was required.

#### 2.6.2. Case-mix

According to DRG classification, an estimation of average weight of all ambulatory procedures was calculated.

#### 2.6.3. Average weight

Measurement based on the estimation of DRG relative costs in U.S.

#### 2.6.4. Postdural puncture headache (PDPH)

Acute onset of position—related headache after spinal anaesthesia, occurring within 24 h after spinal

anaesthesia, and mainly related to the size of the needle.

2.6.5. Transient neurologic symptoms (TNS)

Acute onset of low back pain with transient radiating pain into the lower extremities, buttocks or both, occurring within 24 h after spinal anaesthesia.

3. Results

Between September 1997 and October 2000, 3502 patients were operated on in our ambulatory surgery unit. Of these, 144 had an unplanned admission (global rate: 4.1%). The UAI has diminished gradually due to increasing experience of ambulatory surgery by the surgical teams. In 1997, the UAI was 8.5% (33 of 389 patients), which diminished to 4.3% in 1998 (47 of 1103 patients), and to 2.7% in 1999 (28 of 1044 patients). UAI was 3.8% in year 2000 (37 of 977 patients) (Fig. 1).

3.1. Rate of unplanned admissions by services

Units involved in the study were ophthalmology (1007 patients), general surgery (844 patients), orthopaedics (646 patients), urology (499 patients), ENT (329 patients) and gynaecology (177 patients).

The service with the highest UAI rate was gynaecology (10.7). The second highest rate was in ENT surgery (6.1%) and this was followed by general surgery (5.9%), ophthalmology (2.3%) and urology (2%).

3.2. Classification of admissions by causes

Unplanned admissions were classified in two groups according to their causes (Table 1):

- (I) Specific complications: 109 admissions (75.7%) and,
- (II) Incorrect selection of patients for AS: 35 admissions (24.3%).

3.2.1. Specific complications

The most frequent complications were postoperative bleeding (23 cases, 15.9%), more extensive surgery than anticipated (22 cases, 15.3%), postoperative pain (18 cases, 12.5%), and drowsiness/dizziness (10 cases, 6.9%).

Twenty-three patients were admitted due to bleeding: 10 general surgery (43.4%), six ENT (26.1%), and four gynaecology (17.4%). Admissions due to more extensive surgery was most frequent in general surgery (nine cases, 41%), followed by orthopaedics and gynaecology (eight cases each, 18.1%). Postoperative pain was the third most frequent cause of admission: most patients had undergone general surgery (eight cases, 44%), and orthopaedic surgery (seven cases, 38.8%). The presence of nausea/vomiting, described as a frequent cause of admission in AS, accounted for 10.4% (15 patients) in our study. The distribution by service of this complication was ophthalmology five patients (33.3%), gynaecology four patients (26.6%) and ENT four patients (26.6%).

3.2.2. Incorrect selection of patients

The most frequent cause of inadequate selection of patients was non-detection by the surgeon that the patient lived alone (14 cases, 9.7%). Five patients showed distrust or fear of being discharged, which can be interpreted as deficient preoperative evaluation. Hospital admissions due to inadequate selection of the patients for AS have been reduced, falling from 39.3% in 1997, to 17.4% in 1998, 28% in 1999 and 8.1% in 2000. In four patients, psychiatric pathology was not registered at the preoperative evaluation. The other admission causes are shown in Table 1.

The follow up of the causes of admission during the period of the study let us adopt several measures to reduce the incidence of specific complications. All complications except admission for pain and drowsiness/dizziness were reduced as is shown in Table 2.

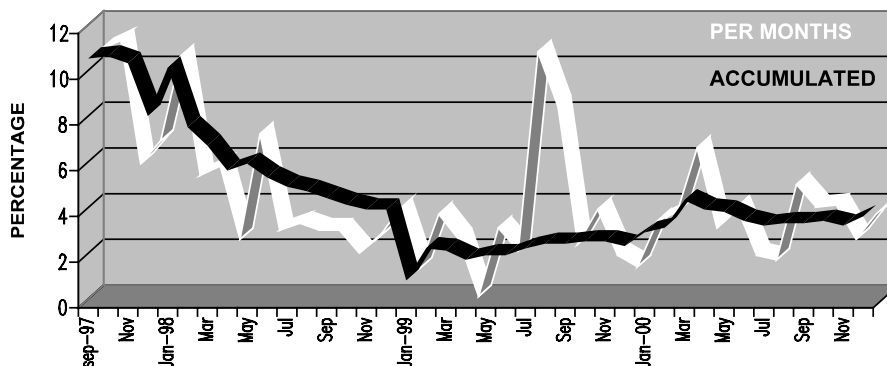


Fig. 1. UAI evolution (accumulated and per months).

Table 1  
Unanticipated admissions by causes

| Speciality                                  | General surgery | Orthopaedics  | ENT           | Ophthalmology  | Gynaecology    | Urology     | Total       |
|---|-----------------|---------------|---------------|----------------|----------------|-------------|-------------|
| <i>Specific complications</i>               |                 |               |               |                |                |             | 109 (75.7%) |
| Haemorrhage                                 | 10              | 1             | 6             | –              | 4              | 2           | 23 (15.9%)  |
| More extensive surgery                      | 9               | 4             | 2             | 1              | 4              | 2           | 22 (15.3%)  |
| Pain  | 8               | 7             | 1             | –              | 2              | 0           | 18 (12.5%)  |
| Nausea/vomiting                             | –               | 2             | 4             | 5              | 4              | –           | 15 (10.4%)  |
| Drowsiness/dizziness                        | 3               | –             | 1             | 4              | 2              | –           | 10 (6.9%)   |
| No specified                                | –               | –             | 2             | –              | 1              | 2           | 5 (3.5%)    |
| Postdural puncture headache                 | 3               | –             | –             | –              | –              | –           | 3 (2.1%)    |
| Respiratory insufficiency                   | 1               | –             | 2             | –              | –              | –           | 3 (2.1%)    |
| Urinary retention                           | 1               | –             | –             | –              | –              | 1           | 2 (1.4%)    |
| Postoperative fever                         | –               | –             | –             | –              | –              | 2           | 2 (1.4%)    |
| Iris hernia                                 | –               | –             | –             | 2              | –              | –           | 2 (1.4%)    |
| Bronchospasm                                | –               | 1             | –             | –              | –              | –           | 1 (0.7%)    |
| Convulsions                                 | –               | 1             | –             | –              | –              | –           | 1 (0.7%)    |
| Increased ocular pressure                   | –               | –             | 1             | –              | –              | –           | 1 (0.7%)    |
| <i>Incorrect selection</i>                  |                 |               |               |                |                |             | 35 (24.3%)  |
| Live alone                                  | 5               | 3             | –             | 5              | 1              | 1           | 15 (9.7%)   |
| Live in rural area                          | 1               | –             | 1             | 2              | 1              | –           | 5 (3.5%)    |
| Psychiatric pathology                       | 1               | 2             | –             | 1              | –              | –           | 4 (2.7%)    |
| Fear to be discharged                       | 4               | –             | –             | 1              | –              | –           | 5 (3.5%)    |
| Inadequate selection for ambulatory surgery | 3               | –             | –             | –              | –              | –           | 3 (2.1%)    |
| Haemodialysis program                       | –               | –             | –             | 2              | –              | –           | 2 (1.4%)    |
| Oral anticoagulation                        | 1               | –             | –             | –              | –              | –           | 1 (0.7%)    |
| Total                                       | 50/844 (5.9%)   | 22/646 (3.4%) | 20/329 (6.1%) | 23/1007 (2.3%) | 19/177 (10.7%) | 10/499 (2%) | 144 (4.1%)  |

### 3.3. Admissions related to the type of intervention

We studied the type of interventions that most frequently were responsible for hospital admissions. The type of surgery is one of the most important factors related to the unplanned admission rate. Thus, depending on which specialities are included in the ambulatory surgery programme, this index may vary importantly. In our study the distribution of procedures by surgical specialities was: ophthalmology 1007 patients (28.7%); general surgery 844 patients (24.2%); orthopaedics 646 patients (18.4%); urology 499 patients (14.2%); ENT 329 patients (9.4%) and gynaecology 177 patients (5.1%). The procedures with the highest admission rates were: gynaecologic laparoscopy 50%, hysteroscopy 26%, septoplasty 22%, haemorrhoidectomy 25%, orchidopexy 11%, hydrocelectomy 10%, inguinal hernia repair 8%, and knee arthroscopy 4.2%. The rest of the results by services are shown in Table 3.

### 3.4. Admissions related to the type of anaesthesia

According to the type of anaesthesia, patients were grouped into three categories:

- Local anaesthesia with monitoring (MAC): 1757 patients (50.8%)
- Regional anaesthesia: 1136 patients (31.8%)
- General anaesthesia: 609 patients (17.4%).

Table 2  
Incidence of admissions causes during the study (%)

| Cause of admission     | 1997 | 1998 | 1999 | 2000 |
|------------------------|------|------|------|------|
| Nausea/vomiting        | 12.1 | 15.9 | 3.6  | 2.3  |
| Postoperative bleeding | 9    | 31.8 | 14.3 | 6.9  |
| Postoperative pain     | 6    | 11.4 | 10.7 | 23.2 |
| More extensive surgery | 0    | 2.3  | 14.3 | 2.3  |
| Drowsiness/dizziness   | 3    | 11.3 | 3.6  | 4.6  |
| Live alone             | 15.1 | 2.3  | 7.1  | 2.3  |
| Live in rural area     | 0    | 2.3  | 7.1  | 2.3  |

Table 3  
Unplanned admissions by the type of operation

| Diagnostic/procedure       | No. operations | No. admissions | % Admissions |
|----------------------------|----------------|----------------|--------------|
| <i>General surgery</i>     |                |                |              |
| Haemorrhoidectomy          | 4              | 16             | 25           |
| Inguinal hernia            | 290            | 23             | 7.9          |
| Epigastric hernia          | 2              | 26             | 7.7          |
| Benign breast tumor        | 100            | 6              | 6            |
| Radiocephalic A–V fistulae | 56             | 3              | 5.4          |
| Varicose vein stripping    | 58             | 3              | 5.2          |
| <i>Orthopaedics</i>        |                |                |              |
| Knee arthroscopy           | 212            | 9              | 4.2          |
| Hardware removal           | 95             | 2              | 2.1          |
| <i>Urology</i>             |                |                |              |
| Orchiopexy                 | 27             | 3              | 11.1         |
| Hydrocelectomy             | 29             | 3              | 10.3         |
| Circumcision               | 217            | 1              | 0.5          |
| <i>ENT</i>                 |                |                |              |
| Septoplasty                | 9              | 2              | 22           |
| Tonsillectomy              | 124            | 8              | 6.5          |
| Miringoplastia             | 16             | 1              | 6.3          |
| <i>Ophthalmology</i>       |                |                |              |
| Strabismus surgery         | 36             | 4              | 11.1         |
| Cataract surgery           | 951            | 18             | 1.9          |
| <i>Gynaecology</i>         |                |                |              |
| Diagnostic laparoscopy     | 6              | 3              | 50           |
| Hysteroscopy               | 26             | 3              | 26           |
| Laparoscopic sterilization | 73             | 5              | 6.8          |

Study by the type of anaesthesia showed that from 144 unplanned admissions, 63 (43.8%) were operated on under regional anaesthesia, 43 (29.7%) under general anaesthesia, and 36 (25%) under local anaesthesia. In two patients, the type of anaesthesia was not recorded. The most significant differences were the registration of pain in 31.7% of patients with regional anaesthesia and the presence of drowsiness (18.6%) and nausea/vomiting (13.9%) in the general anaesthesia group. The incidence of admission causes attributable to the type of anaesthesia are shown in Table 4.

3.5. Complexity of ambulatory surgery

In order to be able to compare the activity, efficiency and different quality indicators, it is necessary to estab-

Table 4  
Rate of unplanned admission and causes according to the type of anaesthesia

|                               | Type of anaesthesia (%) |          |         |
|-------------------------------|-------------------------|----------|---------|
|                               | Local-MAC               | Regional | General |
| Rate of UAI                   | 2                       | 5.5      | 7       |
| <i>Cause of admission</i>     |                         |          |         |
| Pain                          | 5.5                     | 31.7     | 2.3     |
| Drowsiness/dizziness          | 8.3                     | 1.6      | 18.6    |
| Nausea/vomiting               | 8.3                     | 1.6      | 13.9    |
| Bronchospasm                  | 0                       | 0        | 2.3     |
| Respiratory insuf.            | 0                       | 0        | 2.3     |
| Urinary retention             | 0                       | 1.6      | 0       |
| Postdural puncture headache   | 0                       | 1.6      | 0       |
| Transient neurologic symptoms | 0                       | 1.6      | 0       |

lish quantitative and easily measurable indexes of complexity. Complexity should include not only the surgical technique, but the complexity of the patient as well. In the present work, we have only considered the case-mix on the basis of the ‘Average weight’, derived from the DGR classification. The average weight of our ambulatory surgery unit was 0.955. The distribution by services was the following: general surgery 1.465; orthopaedics 1.002; ophthalmology 0.933; gynaecology 0.8099; urology 0.786 and ENT 0.732. As it is shown in Fig. 2, we could not find any relationship between the UAI and the average weight of our patients (Fig. 3).

4. Discussion

From the different alternatives to conventional hospitalisation developed in the last decades, ambulatory surgery has been the one with the greatest growth, not only with a higher index of substitution, but also, with

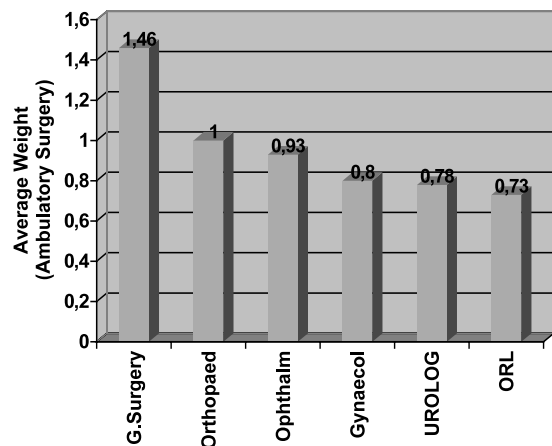


Fig. 2. Average weight of ambulatory surgery procedures by services.

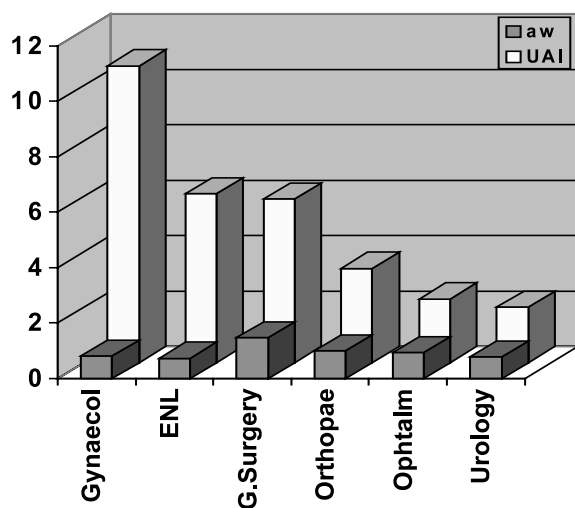


Fig. 3. Relation between the average weight and the UAI.

more complex interventions made to patients with higher biological risk [2–4]. Once developed, it is necessary to implement indicators that, when measured in a continuous and systematic form, allow the monitoring of the quality of the ambulatory surgery which we offer to our patients, as well as improving the optimisation of health care resources. The importance of these indicators is fundamental in the application of standards that allow the comparison of results between different ambulatory surgery programmes, with the ones of our own unit. Ideally, these indicators must be valid, significant, easy to measure and applicable to all units. The UAI fulfils the above requirements. However, to be able to compare the activity, efficiency and quality through these indicators, it is necessary to establish a correction factor that, quantifies the complexity of the operation, resources consumption and the complexity of the patients treated (co-morbidity, anaesthetic risk, etc.). The success of an ambulatory surgery unit depends on the application of a multidisciplinary and rational method of work in which patients and families play a fundamental role. Both of them assume, in conjunction with physicians, the control and postoperative care at home, thus in addition to improving technology, anaesthetic and surgical care, it is necessary to apply a method of exhaustive information to our patients and their ‘carers’.

The unplanned admission of a patient scheduled for ambulatory surgery must be avoided as much as possible, because it not only is an added financial burden for the Health Care System, but, also a stress factor for the patient and a disturbance for their family. The published data vary greatly ranging from below 1 to 11%, including differences between public and private centres [1,4–8]. Prospective measurement of UAI allowed us to evaluate the development of our unit, decreasing from 8.5% in 1997, to 4.3% in 1998, 2.7% in 1999 and 3.6%

in 2000, with an accumulated present global index of 4.1%.

Some recent studies have tried to identify predictive factors for anticipated admission. Amongst them, male gender, ASA-II and -III patients, duration of surgery longer than 40 min, postoperative bleeding, excessive pain, nausea and vomiting, and drowsiness and dizziness have been the most frequently described [1,5].

Different forms have been used to group the causes of admission. Chung and coworkers [5], classified the causes of admission as surgical, anaesthetic, medical or social. In order to detect and to correct operative problems, we grouped unplanned admissions in two categories:

- (I) Admissions by incorrect selection of patients (24.3%).
- (II) Admissions by specific complications (75.7%).

When UAI is prospectively registered and periodically reported to the involved units, it permits early detection of avoidable admissions such as social problems (e.g. patients who live alone). The study of admissions by specific complications is oriented directly to the problem, and permits a multidisciplinary approach.

#### 4.1. Incorrect selection of the patients

Although UAI by incorrect selection of patients should be theoretically low, the reality demonstrates the contrary [1,5,9]. Incorrect selection caused 24.3% (35 cases) of our admissions. As the services have gained experience, this index has diminished from 39.3% in 1997 to 8.1% in 2000. From these 35 cases, 14 patients (9.7%) had to be admitted because they lived alone, and in addition, five patients (4.5%) were not discharged because they lived in a rural location too far away from the hospital, showing that physician’s preoperative evaluation clearly failed. In year 2000, only one patient was admitted for this reason. Special efforts must be made in this specific topic because it is probably the one that, with a simple preoperative work up, can be most easily lowered.

#### 4.2. Specific complications

Analysis of unplanned admissions by specific complications allowed us to know which are the most frequent causes in each surgical service. Actualised data permits investigation of specific causes, pointing out avoidable problems, and allowing the development or improvement of clinical protocols for postoperative management.

#### 4.3. Haemorrhage

Twenty-three patients were admitted because of bleeding from the operative site (16% of unplanned

admissions). This problem continues to be a stress factor for patients and surgeons. When disorders of coagulation can be reasonably ruled out, attention must be directed toward a meticulous dissection and intraoperative control of bleeding points. The fact that other published series show postoperative bleeding rates as low as 1% [5] must make us reconsider this important problem.

#### 4.4. *More extensive surgery*

Twenty-two patients of 144 (15%), were admitted because the indication for surgery was considered in the operation room to be non-suitable for ambulatory surgery. The prospective measurement of this cause of admission showed a 3% rate in 1997, 2.3% in 1998, 14% in 1999, and 39.5% in 2000. The most logical explanation must be that more complex operations in patients with higher morbidity were scheduled in more recent years. This must reinforce the importance of meticulous preoperative evaluation and providing detailed information to patients and their carers [10].

#### 4.5. *Pain*

Pain continues to be one of the more frequent causes of unplanned admission in ambulatory surgery, ranging from 5.3 to 12.1% [1,5,11,12] and one of the most stressful for patients. Several predictive factors of severe pain have been pointed out including body mass index, duration of anaesthesia and type of surgery [11]. As in other studies general surgery and orthopaedics were the specialties where pain was the most frequent cause of admission. In our study admission for pain was registered in 12.5% of patients. Specifically, pain has been the only increasing complication with a rate of 23.2% in year 2000. This result has made us recently review the analgesic protocol of our unit and adopt several measures:

1. Inclusion of a preemptive analgesia protocol [13].
2. Multi-modal analgesic therapy.
3. Better adjustment of analgesic doses at home according to body mass index [11].
4. Wound and ilioinguinal infiltration with bupivacaine 0.25% after interventions considered specially painful (e.g. haemorrhoidectomy, inguinal hernia repair etc.) [14].

#### 4.6. *Nausea/vomiting*

Nausea and vomiting has been traditionally considered a frequent cause of unplanned admission in ambulatory surgery. Rates of admission vary from 10 to 30% [3,5,6,15,16]. Different factors have been implicated in precipitating postoperative nausea and vomiting like previous history, motion sickness, specific types of

surgery (e.g. strabismus repair, gynaecologic laparoscopy, middle ear surgery etc.), and certain anaesthetic agents like halogenated gases [17–20]. Nausea and vomiting was responsible for 10.4% of admissions in our study. Considering all the factors implicated, i.e. its high incidence, the economic and social consequences of unplanned admission, and the relatively high cost of serotonin receptor antagonists, we initiated several measures for prophylaxis and management:

1. Antiemetic prophylactic protocol with ondansetron (4 mg IV) for high-risk patients at the end of the surgical procedure [15].
2. Use of total intravenous anaesthesia in high-risk patients.
3. Reviewing the necessity to fulfil the requirements of oral tolerance for discharge in paediatric patient's [21].
4. Special care of hydration requirements [14].
5. A combined regimen of antiemetic therapy in high-risk patients because of its synergistic effects.

Implementation of these measures has led us to reduce the incidence of postoperative nausea and vomiting as a cause for admission, from 16% in 1998 to 2.3% at the end of year 2000.

#### 4.7. *UAI by the type of anaesthesia*

As in other series, local anaesthesia and monitored anaesthetic care had the lowest admission rate (2%) [18,22]. We could not find differences between regional and general anaesthesia (5.5 and 7%, respectively). Drowsiness/dizziness and nausea/vomiting were much more frequent in general anaesthesia patients (18.6 and 13.9%) when compared with regional anaesthesia patients (1.6 and 1.6%). Pain was a more frequent complication after regional anaesthesia (31.7%).

#### 4.8. *Predictive factors of unplanned admission*

Studies have tried to determine predictive factors of unplanned admission [1,5]. In these studies, significant factors described were ASA-II and-III status, duration of surgery more than 40 min, pain, postoperative bleeding, nausea/vomiting and spinal anaesthesia with profound sedation. General or regional anaesthesia is not considered as a predictive factor because it is mostly dependent on the type of surgery [11].

The key factor to diminish the unanticipated admission index in ambulatory surgery is to apply a multitask work force, with continuous measurement and periodic diffusion of results to the surgical services involved. Only with actualised information about the UAI index by causes and type of interventions, can we adopt measures to reduce the magnitude of this important variable.

#### 4.9. Limitations of UAI as quality indicator

Although UAI is considered one of the most important indicators of quality in ambulatory surgery, it has several limitations. First, there is some degree of subjectivity by nurses and physicians regarding admission with certain complications such as nausea/vomiting, drowsiness/dizziness or pain. Secondly, a great variability in the tolerance of patients in the face of these complications exists. Thirdly, the outside hospital care (i.e. day hospital, domiciliary care units, etc.) could vary the rates of UAI in different units. Finally, financing of the units (public or private) could influence the rate of UAI, due to the relative ease of accessibility of beds for unplanned admissions.

#### 4.10. Future trends

One important factor to know the capacity of our units is the evaluation of complexity. Actually, the only complexity index is the 'case-mix', which is calculated from the DRG classification. Case-mix reflects an average expenditure of resources of hospitalisation episodes by a group of patients. Thus, case-mix only comports as an indirect indicator, because it mainly represents the financial expenses of a procedure, which not always reflect exactly, either the surgical complexity or the morbidity of the patient, especially in the outpatient setting.

On the other hand, the evaluation of potentially ambulatory DRG, a common indicator frequently used by Health Care Systems including the Spanish one, can determine the degree of 'ambulatoryisation' of surgical procedures, but it does not identify potentially ambulatory DGR patients who do not fulfil the criteria to be operated on ambulatory surgery basis. Although, multiple efforts have been made to design a specific classification of ambulatory patients [23] none of them have been universally accepted and applied.

The development of a mathematical index to group the clinical complexity of the patient and the cost of the process would allow the carrying out of studies of economic profitability of the different types of units (free-standing, integrated, mixed). These studies could evaluate the real impact of ambulatory surgery units in the surgical activity of the hospitals accurately, and could also compare the activity and efficiency of the units to each other.

### 5. Conclusions

1. The systematic measurement of unplanned admission and its evolution in a multidisciplinary task force, allowed us to improve our results.

2. Classification of UAI by specific causes of admission and incorrect selection of patients may detect on-line problems and the application of concrete solutions to reduce the UAI index.
3. In order to compare the results between different ambulatory surgery units, it is necessary to have an international classification of ambulatory patients. In the same way, an objective index to evaluate the surgical complexity and patients' morbidity should be developed.
4. The assessment of processes and results should be based on the selection of standard indicators with systematic and periodic measurement.

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