1 Background to ambulatory surgery and anesthesia

Definitions [1]

The formal distinction between *inpatient*, *ambulatory*, and *outpatient* is quite important to make, although the medical approach will be dictated by the patient, the planned surgical procedure, and the context. This has to do with benchmarking, statistics, finances, and formal rules; as well as defining levels of care with different levels of resource allocation expected.

The International Association of Ambulatory Surgery (IAAS) defines *ambulatory surgery* as: "An operation/procedure, excluding an office or outpatient operation/procedure, where the patient is discharged on the same working day" (http://iaas-med.com/modules/content/Acr977.tmp.pdf), in contrast to inpatient surgery where the patients stay in hospital overnight. Although the American definition, because of old rules of insurance companies and systems of payment, allows for 23-h stays to be classed as ambulatory this does not seem to be a fruitful concept. The whole idea with ambulatory surgery is to have the patient ready for discharge to a setting without health care staffing within the scope of a single working day, basically with the same team of carers involved during all or most of the session. Sessions may be designated as morning, afternoon, or evening, and sometimes overlap between these sessions is required, but whatever the case the fundamental and very simple end point for ambulatory care is that the patient does not spend the night in a staffed health care institution. Hotel or hospital-hotel stay can be classed as ambulatory as long as there are no dedicated health personnel there to routinely look after the patient. Having a backup service if needed, such as a receptionist or even a nurse when requested, falls within the ambulatory concept; the point is that these carers will not look after the patient unless called for by the patient or their chaperone.

The distinction of ambulatory surgery from a simple *outpatient consultation* entailing some procedures is more challenging and not that straightforward to make. Most will agree that all procedures requiring general anesthesia should be classified as ambulatory, including those procedures that are usually done under a general but in some cases can be carried out using regional or local anesthesia or sedation, or a combination of these options. Still there are areas of potential dispute, as the following examples show. Where is the outpatient/ambulatory distinction between a simple scar correction and an extensive plastic surgical procedure where both are carried out under local anesthesia? Diagnostic rectoscopy versus removal of a rectal tumor by a rectoscope? The removal of stitches from a wound versus removal of screws from a bone?

A pragmatic and useful distinction is to designate cases as outpatient when the patient is generally expected not to need any specialized care or specialized surveillance when the procedure is finished. Using this approach an endoscopy (cystoscopy, gastroscopy,

colonoscopy) should not be considered ambulatory unless general anesthesia is used or an intervention (e.g., tumor removal) is required necessitating post-procedural observation in a health care facility in case of bleeding or other complications. Similarly, most procedures carried out using regional anesthesia or deep sedation should be classified as ambulatory where some post-procedural professional observation is required.

Short history of ambulatory surgery and anesthesia [2]

Going back only 200 years presents us with a totally different scenario of health care, and especially surgery, compared with today. The average life expectancy was about 40–50 years, there were no effective painkillers, no antibiotics and hardly any efficient drugs as such, although some herbs with therapeutic potential were in use. Surgery had a very high mortality, the patient dying from cardiovascular stress with unbearable pain during the procedure, from bleeding (there was no intravenous technology available), or from wound infection escalating to sepsis or necrosis (no knowledge about hygiene and sterility; no antibiotics). Nowadays on average about 1 in 10 people have a surgical procedure every year in the developed world, whereas 200 years ago the figure was about 1 out of 2 000–5 000 people. The very few cases done were either quite minor or quick, such as removal of foreign bodies, reposition of fractures, puncture of abscesses, etc., or they were occasionally carried out to treat clearly life-threatening conditions, for example a skull burr hole for extradural hematoma evacuation. The procedures were undertaken in the patient's home or in the field. The first hospitals were built in the time of war near battlefields where it seemed practical to assemble the large number of severely injured soldiers in dedicated tents, huts, or houses, basically for simple wound care and amputations. Some hospitals emerged in the cities as well, to offer services to the poor and homeless; the wealthy and nobility having their health care provided at home. The development of modern anesthesia occurred in the 1840s with ether anesthesia and nitrous oxide being major revolutions in the history of medicine. For the first time it became possible to undertake prolonged and complex surgical procedures on patients whose consciousness was controlled by ether vapor. By the end of the nineteenth century the technology of intravenous infusion and drugs had become available, and cocaine was introduced as the first example of a local anesthetic. Expansion in surgical techniques and technology together with development of sterile routines peroperatively led to a dramatic increase in the number of surgical procedures being undertaken. Many hospitals were built to accommodate the new era. By the beginning of the twentieth century the rule was for all surgery to be undertaken in hospital-like institutions, with patients staying in bed receiving nursing care for many days after the procedure. Even as late as 1960–1970 the general rule was for patients having a cholecystectomy to stay in hospital for at least 3–5 days and even those having a hernia repair stayed in for many days, even for 1–2 weeks in many places.

The modern ambulatory surgery era started just after 1900 with pioneering institutions in the USA and the UK, which had a hospital setup but sent patients home in the evening.

Later development was quite scattered, with pioneering institutions in many places, but it was not until 1970–1980 that ambulatory surgery became a forceful movement with an everyday impact on health care in the western world. Today, about 50–70% of all surgical procedures are ambulatory in the most highly developed countries, whereas the number in Eastern Europe, Africa, and most places in Asia and South America remains less than 5–10%. These percentages are always calculated in terms of procedure number, which is quite different from the "amount" of surgery, which is a term that also encompasses the total

time, personnel, and resources spent on surgery. Obviously, because ambulatory surgery is not possible in major, prolonged, and emergent cases, the fraction of total surgical resources spent on ambulatory cases will be far less than 50–70%.

Why ambulatory surgery?

The usefulness of ambulatory surgery should be discussed in a context of looking at its pros and cons from perspectives of: (1) safety; (2) quality; (3) economics; and (4) education and staff satisfaction.

A pertinent question to ask is why do we send patients home on the same day of surgery in the most wealthy countries, which really could afford to provide an overnight service to their population? As this is a successful approach and accepted by the population, it is probably conceived as being safe and carrying the appropriate quality; otherwise this practice would have been hotly debated. A more complex follow-up question is why ambulatory surgery is not a major feature in less wealthy countries that could make savings by avoiding having many patients staying for days unnecessarily in staffed hospitals. This may be due to the prerequisites of successful ambulatory surgery as discussed in more detail in Chapter 2.

Ambulatory surgery requires an established infrastructure within the ambulatory unit and it is a disciplined and demanding process to change from inpatient to outpatient care. The personnel need to adopt new routines and tighter schedules, the patients need to be better informed, and the surgical and anesthesiological procedures need to be updated for same-day discharge to be feasible. The backup systems outside the hospital, such as phone access, road communication, ambulance systems, and well-informed chaperones, need to be adequate. Further, in most nonwealthy countries the unemployment rate is high and salaries for overnight nurses or carers are low, thus there may not be much incentive (maybe even some resistance) to close down these units during nights and weekends. Also, ambulatory care requires a health care financial system that acts as an incentive for those involved and not as a disincentive as is the case when hospital income is based on inpatient numbers. This is quite evident when looking at, for instance, Germany, where the fraction of ambulatory care was much lower than in other western countries until recently, when the reimbursement system was changed from a system with economic "punishment" of those who carried out ambulatory surgery.

A modern approach is to twist the question round and instead of asking whether a patient could go home and defining the criteria, one could ask, "Is there any reason why this patient should stay overnight?" Then criteria could be laid down for when an overnight stay is needed, based on defined reasons, for example safety, quality, or total economy. Another way of challenging the overnight stay dogma is to ask, "What will be different with inpatient care?" Frequently, "overnight stay" implies that the patient is sent to the ward late in the afternoon. Then patients may be left alone in their rooms for many hours consecutively during the night, unless otherwise requested. Again, questions should be asked about the potential worst-case scenario and issues of perceived quality; namely is the patient care best provided in the hospital or at home with a responsible escort?

Safety

In a study of more than 45 000 patients for 30 days after an ambulatory surgical procedure, Warner et al. concluded that the major morbidity (i.e., respiratory, circulatory, cardiac) was similar to that in the general population not having surgery [3]. In a more recent study of

18 500 Danish ambulatory surgical patients, there were no cases of death or permanent disability that could be ascribed to the procedure during a 90-day follow-up [4]. Some procedures have a relatively high risk, such as tonsillectomy, where a 1 in 10 000 mortality rate was reported in Norway over the last 5–10 years (Raeder, J., data on file), although these deaths were related to substandard care and not to the ambulatory concepts per se. Also, cases of inadvertent artery puncture or gut puncture with peritonitis have been reported with laparoscopy, but, again, these are not related to the ambulatory setting. In a study of ambulatory liposuction in Florida, Vila et al. found a tenfold increase in mortality when these procedures were performed in physicians' offices with improper standards, compared with licensed ambulatory centers [5].

We may conclude on some issues regarding safety in ambulatory care:

a. The safety is very close to 100% when proper ambulatory care is undertaken. This means the patient should feel safe but also that there is zero tolerance for serious errors in patient handling in the ambulatory setting.
b. Ambulatory surgery is safe because of good standards of care. If the standards are suboptimal, ambulatory surgery (as well as inpatient surgery) may not be safe and acceptable.
c. Some procedures will have a risk of rare and/or serious complications that is not avoided by doing the procedure in an ambulatory setting. Thus, care of ambulatory patients should be carried out using the same standards and resources as is care of inpatients.

Quality

There are a number of quality issues in favor of ambulatory care, which are listed below:

a. The risk of having a hospital infection is reduced as the patients are subjected less to the hospital environment, both in terms of exposure duration and also because ambulatory surgery is usually undertaken in premises with less contamination by seriously ill inpatients. In our own study the rate of infection after mixed ambulatory surgery during a 30-day observation period was 3.4%, being mostly benign, superficial wound infections [6]. The infection rate in comparable inpatients was in the range of 5–15%. Also in a study by Holtz and Wenzel the infection rate was about 3 times higher in inpatients when compared with ambulatory surgery [7].
b. Reversible cognitive dysfunction for some weeks or even months after surgery may be seen in up to 20–40% of the patients, more frequently with older age and extensive surgery [8]. The risk of cognitive dysfunction 1 week after hernia repair in elderly patients was significantly reduced from 9.8% with inpatient care to 3.8% (similar to nonoperated) after ambulatory care [9]. This seems logical: elderly patients especially, but also psychiatric patients, patients with cerebral dysfunction, and children, may all be stressed and confused by being subjected to an unfamiliar environment and unfamiliar people, and the longer the exposure the worse the effect. Thus, the sooner these types of patients can go safely back to their familiar environment, the better [10].
c. Less internal transport and fewer carers. This has to do with the shorter chain of treatment in ambulatory care; no wards are involved either pre- or postoperatively and most often the whole sequence from admission to discharge occurs in one area with the same personnel throughout. This increases continuity in terms of information provided

and results in fewer misunderstandings. Also the information may be perceived as being better because the patient has to receive certain information before being discharged, whereas for inpatients the discharge process is often less consistent.

d. Less bed rest and immobility. The whole ambulatory setting is based on elective patients who are mobile and wearing their own clothes when they arrive and when they leave. They should be routinely seated in chairs and walk into theater themselves, unless unable to do so. This contrasts with the inpatient setting, where being in bed and bed rest are the default states. Being mobilized is good for many reasons: better gut function, better lung function, lower risk of thrombosis, and less chance of feeling ill.

e. Fewer delays and cancellations. The ambulatory surgical path is usually organized with its own nursing staff and dedicated facilities. The risk of a case being postponed because of an incidental burden from emergency care surgery or because there is no room in the postanesthesia care unit (PACU) is less than when minor procedures are done as inpatients between major surgery cases.

f. "Home is best." If you ask patients where they want to be after surgery provided that they are and feel safe, have no nausea and no or minor pain, most will prefer to be at home together with a spouse or friend than stay overnight in an unfamiliar hospital room.

Economy

It is beyond the scope of this book to discuss the economics of the ambulatory health care system in detail, but in brief it avoids expenses due to nursing care and patient accommodation in the late evening and overnight. The costs of doing the procedure, including all costs related to surgery and anesthesia, are the same as if the patient were an inpatient. Still, the situation may not be so simple. For a single hospital or unit to make such savings, the ambulatory program needs to be big enough to produce reduced staffing levels. Alternatively, the program needs to be large and predictable enough to release beds to other patients, thus increasing hospital production rather than saving money. In order for patients to have a rapid and uneventful recovery, more expensive anesthetic drugs may have to be used, but this expenditure may be recouped in reduced length of time in the operating room and reduced stay and need for nursing care in the PACU. It has also been shown in many places that focusing on ambulatory care results in the less dogmatic use of routine tests and associated savings, as most tests on ambulatory patients are done only for specific indications. The involvement of fewer carers reduces the need for handover between carers and reduces the extent of double documentation, which is often seen when many people are involved with one patient. Establishment of an ambulatory service may by itself improve the efficiency of the hospital, as a large amount of work occurs in a predictable manner with few cancellations and no interruptions by and disputes over emergency cases. A potential cost problem with ambulatory care is when very expensive equipment (e.g., laparoscopy racks, robots, etc.) is used only during the daytime; but this may be solved by have dedicated afternoon lists or by using the equipment in other places in the hospital when the ambulatory operating room is down. Ambulatory care may also be expensive if too many patients planned for ambulatory care have to be admitted unexpectedly, if they need a lot of expert care after being sent home, or if there is a high rate of unplanned readmission.

Education and staff satisfaction

Most staff will be happy to reduce the number of hours worked during evenings, nights, and weekends; thus recruitment and continuity in ambulatory care units are usually very good. However, there is some concern that ambulatory cases are too predictable and rarely present with emergencies and difficult situations. This may be overcome by having personnel rotate in and out of the unit for those who want to, and by having regular training in important emergency routines, such as advanced cardiorespiratory resuscitation. For the anesthesiologist it may be useful to have emergency praxis in between work at the ambulatory unit, or to attend training sessions or simulations in relevant emergency work, such as difficult airway, anaphylaxis, and invasive procedures.

As ambulatory surgery becomes more extensive, it will also be necessary to make the ambulatory unit an area of education and training for medical students, surgeons, anesthesiologists, and nurses. This should be recognized as requiring dedicated resources, such as instructors, and potentially delaying case performance and turnover while remaining compatible with high-quality care provision and effective running [11]. A model for surgical education is to have a senior surgeon ready to take over if a case is prolonged beyond certain limits, or having the trainee do the case with the senior surgeon supervising.

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2 Organization of ambulatory surgery and anesthesia

Physical organization [1]

There are different levels of organizing ambulatory surgery; everything from a single ambulatory case performed between scheduled inpatient procedures in an inpatient organization to freestanding, complete hospitals dedicated completely to ambulatory care.

The single ambulatory patient integrated in an inpatient organization

This implies that occasional inpatients are treated as ambulatory; that is, they are discharged in the afternoon or evening after surgery instead of staying overnight. This is assessed individually for each case and patient, and may be planned in advance or organized ad hoc as a consequence of uneventful surgery and recovery, or perhaps as a request from the patient or personnel, "Is there any reason for this patient to stay in the hospital overnight?"

It is hard to see much advantage of the ambulatory approach when it is applied in this way. The hospital cannot plan to employ fewer staff (thus making savings) during evenings and overnight and the patient is exposed to the full hospital experience with its potential for delays, cumbersome case flow, and less consistent exchange of information. However, it may be beneficial for the patient to go home even if an overnight stay had been planned or is the rule, provided that analgesia, anti-emesis, and safety are well taken care of. This model may be the only option in units where the majority of patients are inpatients, or in very small hospitals that, as a rule, only provide inpatient care.

This may also be a model when trying to expand ambulatory care to new patient categories. In such a situation ambulatory care may be introduced very gently by saying to everyone (patient, surgeon, staff) in advance:

> Mr./Mrs. X is an inpatient and planned to be treated as an inpatient; we will go through the full inpatient routine and have an overnight bed ready. However, when surgery is finished and if the recovery and total situation are uneventful, we will evaluate the case for basic discharge criteria. If these are all fulfilled we will send the patient home.

Thus, the model may work as a pilot project for expanding day care. The next step may be to say, "We have two similar patients, both planned as inpatients, but we expect that at least one of them will go home, thus we will only plan for one overnight bed."

Then the project may be expanded to three or four patients and when it becomes evident that most of these patients actually go home, you have effectively established a new ambulatory patient treatment chain very smoothly, and may then move to the next phase of saying, "These will be ambulatory cases, but we still need options available for inpatient care in some cases, either planned or unplanned."

The ambulatory program as part of an inpatient program or organization

This means that you deliberately plan for an ambulatory program as a minor part of the ordinary inpatient setting. It may be necessary to dedicate a specific day and/or operating theater to ambulatory care, or, more commonly, to plan one or more weekdays where at least one theater is reserved for ambulatory care. Once the ambulatory care becomes a planned issue for a defined number of patients or category of patients, you may be in a position to dedicate the following to the ambulatory setting both preoperatively and postoperatively: instructions, methods of communication, consultant surgeons' time, and postoperative care, i.e., minimizing opioids, minimizing nausea, encourage mobilization, etc. While there may be dedicated personnel for the ambulatory cases or days, they will probably have to participate as inpatient workers rather than being full-time and working fully trained in the ambulatory setting. A pragmatic solution is to have some secretaries, preoperative nurses, and postoperative nurses fully dedicated to the ambulatory patients on those days when the ambulatory program is followed. Also the surgeons and anesthesiologists should sign up to the philosophy of the ambulatory program in terms of their attitudes toward information exchange and focusing on uneventful and fast recovery. Despite this, patients may still experience much of the cumbersome inpatient routines, and the hospital may not be in a position to make financial savings as the limited and often unpredictable number of ambulatory patients within the dominantly inpatient setting may be hard to translate into real changes in organization, staffing, and thus economy. Still this model may be a good alternative in small hospitals with so few ambulatory cases that they cannot justify having a separate unit running five full days a week.

The ambulatory unit integrated into an inpatient hospital

This occurs when there are enough ambulatory patients to run an ambulatory unit, but major facilities must be provided by the inpatient hospital. The unit runs five full days a week, but there may also be a unit staffed by part-time workers on either short days or short weeks. In order to be called a separate unit (different from the model in Section 2.1.2) there should be an area and personnel dedicated fully to ambulatory care. Usually this is a unit with at least a reception area and a phase II recovery and discharge area. Often it will also include preoperative holding and phase I recovery areas (i.e., the postoperative care unit, PACU). The integration with inpatients usually occurs in the operating theater, which is part of the inpatient hospital facility, but with specific days or theaters dedicated to ambulatory care.

The benefit of this organization is that it enables the hospital to take full advantage of employing a dedicated ambulatory staff for all preoperative and postoperative care, and of providing the patient with the comfort of not being exposed to the full hospital setting. The hospital may attain better cost-efficiency through the shared use of expensive theaters and specialized equipment for an increased total number of hours per week than can be achieved with two fully separate locations. The downside remains the demanding logistics implicit in coordinating those parts of the treatment pathways that are shared with inpatients. Problems may arise through having personnel who are not dedicated to ambulatory care and the potential for cancellation of the ambulatory program should the inpatient organization become overloaded with emergency cases.

The freestanding ambulatory unit inside the inpatient hospital

This occurs when the ambulatory program is run totally separately from inpatient program; including having its own premises, and dedicated pre-, per-, and postoperative staff, with the exception of maybe the surgeons and anesthesiologists, who are often employed by the "mother" hospital. The doctors may be available for ambulatory care on a case-by-case basis, for a full list or a full day, for a limited period, or as a permanent employee. The good aspect of this model is that a sophisticated hospital providing backup for extra testing and unexpected emergencies is close by and easily accessible. An unexpected transition to inpatient care or the need for prolonged recovery is usually easily achieved. There will also be the potential for some flexibility in the use of very expensive equipment and flexibility on the part of the doctors, who may manage their time across in-hospital tasks and ambulatory care. This has good and bad aspects: a flexible day may mean that an ambulatory case has to wait for a doctor who is not dedicated to the ambulatory program and busy with something else in another part of the hospital. Experience shows that with all models of ambulatory care that are provided close to the rest of the hospital, the nurses will spend some time and effort bleeping the doctors, who are working constantly across the site.

Having fully separated units makes it easier to account for cost-efficiency measures, and to have separate budgets and accounting. It also makes it easier to promote team-working and to enable everyone in the treatment chain to reap the benefits of efficient working. This acts as an incentive to get the lists done without delay so as to avoid having to remain after hours as no one from the inpatient hospital is available to take over these duties in the evening or overnight.

The freestanding ambulatory unit as a satellite of the inpatient hospital

This is a model in which the ambulatory unit is physically separate from the rest of the hospital, either at the end of a long corridor or in a separate building some distance away. The idea is to be far enough away from the rest of the hospital that doctors and other personnel will be unable to leave the unit between cases, while being close enough for any extra tests, access to expertise, or unplanned admissions to be achieved fairly easy. Making the doctors stay in the unit usually eliminates the problem of their not being available to start the next case, and it usually also speeds up other parts of the treatment, as doctors are more likely to use any small break to talk with the patients, finish patient reports, and be more involved in the ambulatory team. Being geographically distant also protects the ambulatory personnel from being moved to provide inpatient care if the main hospital is experiencing staff shortages, is overworked and understaffed, or there are other problems in running the inpatient unit. The downsides of being at a distance are the somewhat more demanding logistics for patient transportation when extra tests or evaluations are needed or in cases of an unplanned admission.

The freestanding ambulatory unit or hospital

Freestanding hospital

This has all the benefits of being a separate unit in terms of personnel, routines, and economy. The downside may be the need to bring in extra services which have to be organized and usually paid for. If the ambulatory hospital is big enough, many of these

extra services may be part of the organization, such as laboratories, cardiology services, radiology services and so on, and they may even be set up to arrange unplanned overnight stays if needed. There will always be some need for the patient with a rare and serious complication to be admitted to an inpatient hospital, and this should be included in the planning. For smaller freestanding units there may be two ways of obtaining external service. The first is to have established connections and systems for making appointments with a neighboring inpatient hospital; the alternative is to limit the need for such services as much as possible. The latter may be accomplished by having a narrow selection of procedures on offer and then to focus on optimizing the selective "production line" within the organization. Further one can try to avoid trouble by only taking healthy patients assessed as grade I or II according to the American Society of Anesthesiologists (ASA) status, with a well-organized family situation, who live close by, and so on.

Freestanding office based

These units almost always concentrate on a narrow selection of procedures, for instance doing solely ear, nose and throat (ENT), solely plastic surgery, solely dental surgery, and so on. Most of them will also place restraints on the patient's general health and social situation, in order to avoid serious complications and problems. These units may be very efficient because they can make very stable and tight teams with logistics focused solely on one type of patient and surgery. They may be more pragmatic and less dogmatic than larger clinics in terms of what personnel and routines are actually needed; for instance, not having excess scrub staff and drapes, not having fully certified nurses as assistants, and so on. Problems for such units are then ensuring that they fulfill all the requirements for safe running and that they have proper backup routines for any potentially dangerous events. They may be lulled into a false sense of security because they have a fairly low number of cases compared with a big hospital and as a consequence have infrequent exposure to problems. Then, should a very rare and occasionally serious complication happen, the whole clinic may be under threat and investigated to see whether their formal safety aspects and backup routines were adequate.

What is the optimal size of a unit?

Unit size is usually defined as the number of theaters and surgical teams working simultaneously within it. Two major trends are important in this context: (1) the bigger the unit's size the greater its potential for synergy effects of logistics, personnel, and equipment serving more than one team at a time; (2) the bigger the unit's size the greater the amount of effort needed to organize, coordinate, and plan the work it carries out. Bigger units are more flexible in some ways, for example in their ability to handle staff sick leave smoothly, and to manage the unpredictable length of some cases, cancellations, and any extra services required unexpectedly.

Having only one theater may work well and efficiently if the turnover time between patients is not too great. This means that minimal time should be spent on cleaning and draping and that there should be enough instruments to allow for smooth running, avoiding delays while equipment is sterilized.

With two theaters, two full teams may work in parallel or, if the cases are numerous and short, one surgeon may go between the theaters, which optimizes the efficient use of their time. In systems with nurse-anesthetists, synergy may be achieved by having one anesthesiologist serving two theaters concomitantly, with one nurse in each. With three theaters and a