Research

# Need for critical care in gynaecology: a population-based analysis

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## Abstract

**Introduction** The purpose of this study was to note potential gynaecological risk factors leading to intensive care and to estimate the frequency, costs and outcome of management.

**Materials and methods** In a cross-sectional study of intensive care admissions in Kuopio from March 1993 to December 2000, 23 consecutive gynaecological patients admitted to a mixed medical–surgical intensive care unit (ICU) were followed. We recorded demographics, admitting diagnoses, scores on the Acute Physiological and Chronic Health Evaluation (APACHE) II, clinical outcome and treatment costs.

**Results** The overall need for intensive care was 2.3 per 1000 women undergoing major surgery during the study period. Patients were 55.4 ± 16.9 (mean ± SD) years old, with a mean APACHE II score of 14.07 (± 5.57). The most common diagnoses at admission were postoperative haemorrhage (43%), infection (39%) and cardiovascular disease (30%). The duration of stay in the ICU was 4.97 (± 9.28) (range 1–42 ) days and the mortality within 6 months was 26%, although the mortality in the ICU was 0%. The total cost of intensive care was approximately US$7044 per patient.

**Conclusions** Very few gynaecological patients develop complications requiring intensive care. The presence of gynaecological malignancy and pre-existing medical disorders are clinically useful predictors of eventual outcome, but many cases occur in women with a low risk and this implies that the risk is relevant to all procedures. Further research is needed to determine effective preventive approaches.

**Keywords** critical care, gynaecology, intensive care unit

## Introduction

Postoperative morbidity and mortality, especially in cancer patients, have been reviewed in a number of studies in the field of gynecology [1–3]. Morbidity after gynaecological surgery ranges from approximately 10% to 20%, whereas mortality is extremely rare [4–6]. Clinical guidelines and recommendations based on the unusual events of patient death are of little importance in medical care of the general population, and therefore information on severe acute morbidity as evidenced by near-miss cases and utilisation of intensive care units (ICUs) may help to audit the quality of care in a more meaningful manner. Reports on the utilisation and outcomes of critical care services required in the management of all gynaecological patients are rare. The other side of the coin is that severe morbidity and the need for intensive care poorly reflect the long-term effects leading to mortality after discharge from hospital. As far as we are aware, studies of the need for intensive care in gynaecology have not been recently conducted in the Nordic countries, where patient care is organised by public health care units, and thus virtually all women receive modern care. This study was undertaken to

APACHE II = Acute Physiological and Chronic Health Evaluation II; ICU = intensive care unit; IVF = in vitro fertilisation; TISS = Therapeutic Intervention Scoring System.

evaluate the population-based frequency, causes, costs and outcome of intensive care in gynaecology.

## Materials and methods

We retrospectively reviewed all gynaecological patients treated in the intensive care unit at Kuopio University Hospital from March 1993 to December 2000. In this study, by 'gynaecological patients' we mean patients who were admitted to the hospital primarily on gynaecological indications. Our institution is a tertiary care facility dealing with all kinds of gynaecological care from assisted reproduction (180 IVF cycles per year) to outpatient (950 operations) and major surgery (1020 patients each year), including a gynaecological oncology service, and it is part of a general hospital complex having a surgical/medical intensive care unit. About 10% of the operations are transfers from a provincial referral base of one million inhabitants, mainly because of invasive cancer or pre-existing medical disorder considered to pose a high risk to the woman. Our hospital has 24-hour on-site consultants in gynaecology, anaesthesia and intensive care. Laboratory, blood bank and haematology facilities are available in the unit. Gynaecological patients with respiratory failure or unstable haemodynamics are transferred to the ICU.

The Intensive Care Unit at Kuopio University Hospital is a 22-bed tertiary care and medical/surgical intensive care unit. Intensive care patients are treated by critical care staff physicians. The anaesthetist or gynaecologist consults the intensive care physician, who makes the decision as to whether or not the patient is to be admitted to the ICU. Patients undergoing radical cancer surgery are routinely monitored during emergence from anaesthesia in the postanesthesia care unit for the first postoperative night, and, if stable the next morning, are transferred to a ward for further postoperative care. In this study, the time in the postanesthesia care unit was not counted as utilisation of the critical care services, and thus patients were admitted to the ICU on specific clinical indication only. Subsequent care is primarily in the hands of the ICU team in close cooperation with the Department of Gynaecology. Our ICU provides all intensive care services for patients aged over 1 year in a primary population of 256,000 inhabitants. All patients in this referral population requiring intensive care are treated in our institution. For the most part, the same staff took care of all the patients over the study period.

Gynaecological patients and women with pregnancy-related complications who were treated in the ICU before 16 weeks of pregnancy were enrolled in this study. Each case requiring intensive care was documented with respect to the marker of severe acute morbidity, the primary factor (the initiating event leading to transferral) and any organ dysfunction or failure (list of organ systems involved). Women who had multiple complications were included under more than one heading. The main purpose of such classification was to assist in prevention programmes. Hospital charts were reviewed to determine the length of time in the ICU, specific interventions and overall outcome of all patients. For each patient, the Acute Physiology and Chronic Health Evaluation (APACHE) II score was calculated at the time of admission [7]. Patients' records for the 6 months following the study were reviewed as regards survival.

To conduct an economic analysis, the intensity of treatment during the ICU stay was evaluated on a daily basis by using the Therapeutic Intervention Scoring System (TISS) for each patient [8]. The costs of intensive care were calculated by dividing the yearly total cost of the department by the total TISS score. Thus, the total cost covered all the salaries, materials, full allocation of step-down costs (e.g. administration, depreciation, rent) and all secondary expenses such as the use of laboratory and imaging facilities and consultations with personnel of other specialities. Overall, the mean cost of one TISS point was US$31, and based on this figure, the total cost of the intensive care of the 23 gynaecological patients was calculated.

## Results

During the study period, there were 8573 gynaecological operations in Kuopio University Hospital. There were 23 women who fitted the definition of a critically ill patient and they were admitted to the ICU, the frequency of admissions being 2.3 per 1000 women undergoing major surgery over the years studied. For comparison, the equivalent figure for urological patients undergoing pelvic surgery was 5.8 per 1000 during the same period of time. Of all gynaecological patients requiring intensive care, two (9%) were received as tertiary referrals from other hospitals. The utilisation rate of the ICU varied from two to six admissions per year during the study period. The mean (± SD) number of days of intensive care required was 4.97 (± 9.28). There was no mortality in the operating theatre or in the ICU, but critically ill patients beyond surgical treatment and with progressive terminal disease were not admitted to the ICU. No specific trend in the utilisation rate during the study period was recorded. Intensive care of gynaecological patients accounted for 0.17% of all admissions to the ICU and for 0.31% of all care days in the unit, and the equivalent parameter with regard to TISS scores was 0.30% of all care days in the unit during the study period.

The clinical characteristics of the women admitted to the ICU are presented in Table 1. Gynaecological malignancies and cardiovascular diseases leading to respiratory failure were the most prevalent disease categories. In comparison with gynaecological patients who had benign diseases, the cancer patients were specifically at high risk for ICU admission, at an odds ratio of 5.46 (95% confidence interval 2.31–13.0) ($P < 0.01$). Of the 23 women admitted to intensive care, 20 underwent gynaecological surgery: 3 of the operations were emergencies and 17 were elective. Reoperation was carried out in 12 cases, either because of postoperative haemorrhage or procedure-related injuries. Women who ended up in

**Table 1**

**Clinical characteristics of gynaecological patients ($n = 23$) transferred to the intensive care unit**

| Characteristic | Finding |
|---|---|
| Mean age (years) (± SD) | 55.4 (± 16.9) |
| BMI (kg/m$^2$) (± SD) | 25.6 (± 5.6) |
| Pre-existing medical disorder | 9 (39%) |
| Gynaecological malignancy | 8 (35%) |
| No surgery | 3 (13%) |
| Time in intensive care unit (d) (± SD) | 4.97 (± 9.28) range 1–42 |
| APACHE II score (± SD) | 14.1 (± 5.57) |
| ARDS | 1 (4.4%) |
| Deaths | 0 (%) |

APACHE II, Acute Physiological and Chronic Health Evaluation II; ARDS, adult respiratory distress syndrome; BMI, body mass index.

**Table 2**

**Reasons for admission of gynaecological patients to the intensive care unit**

| Reason | *n* (%) |
|---|---|
| Postoperative haemorrhage | 10 (43%) |
| Infection | 9 (39%) |
| Cardiovascular disease | 7 (30%) |
| Procedure-related injury | 2 (9%) |
| Pulmonary embolism | 1 (4%) |
| Dysfunctional uterine bleeding in adolescence | 1 (4%) |
| Ovarian hyperstimulation syndrome | 1 (4%) |

**Table 3**

**Interventions for gynaecological patients in the intensive care unit**

| Intervention | *n* (%) |
|---|---|
| Arterial line | 23 (100%) |
| Central line | 5 (22%) |
| Swan–Ganz catheter | 18 (78%) |
| Blood transfusion | 13 (56%) |
| Mechanical ventilation | 15 (65%) |
| Vasoactive infusion | 12 (52%) |
| Haemodialysis | 2 (9%) |

the ICU for reasons unrelated to surgery were one who was admitted to the hospital because of ovarian hyperstimulation syndrome and two with uterine bleeding problems.

The reasons for admission to the ICU are given in Table 2. The most common reasons were postoperative haemorrhage, disease-related complications and infections, with 43% of the 23 cases in need of intensive care being due to haemorrhage, 39% due to infection, 34% due to respiratory failure or heart failure, 9% due to procedure-related injuries and 8% due to other reasons. Causes of haemorrhage included surgical bleeding ($n = 7$) and use of anticoagulants ($n = 3$). One nonsurgical case of haemorrhage was because of profuse dysfunctional uterine bleeding in adolescence. Infections included six cases of septic infection, two of which were secondary to procedure-related injury (one to the bowel and one to the ureter). Many women had multiple complications and were included in more than one category. Anaesthesia was not considered to be the primary cause of or a contributing factor to severe morbidity in any case.

Table 3 lists interventions in the ICU. We do not have a formal policy concerning the use of pulmonary artery catheters and their use is based on the clinical judgement of the intensivist in charge. However, the clinical practice is to use a pulmonary artery catheter when a patient is haemodynamically unstable or has severe respiratory failure. Vasoactive drugs such as norepinephrine, epinephrine, dobutamine and dopamine are not usually used without a pulmonary artery catheter. The high rate of utilisation of pulmonary catheters has not changed in recent years. There were two patients requiring haemodialysis. The first patient was a 46-year-old woman who had had insulin-dependent diabetes for 40 years. She had neuropathy, retinopathy and nephropathy. After operation she developed oliguria and pulmonary oedema unresponsive to vasodilating drugs and diuretics. The other patient was a 70-year-old woman who postoperatively developed sepsis and oliguria.

The overall outcome for women admitted to the ICU was favourable among those treated for reasons other than malignancy, but four deaths (17%) occurred in patients with gynaecological malignancy after they had been transferred to ward care. This in-hospital mortality pattern indicates how extremely ill the group with malignancy was. Two of these patients died as a result of unresponsive septic shock in the ward, one died of pulmonary embolism and one of uncontrolled bleeding. In each case, a multidisciplinary team made the decision not to readmit cancer patients having a poor prognosis (advanced ovarian cancer) to the ICU. The problems that arose were not considered to be a result of poor treatment, but simply beyond the reach of critical care medicine. The causes of death were subsequently confirmed at autopsy. The APACHE II score did not predict the death. After hospital discharge, all but one of the surviving patients returned to their previous social and physical activity. In one case of narcotising fasciitis, clinical improvement followed surgical debridement of superficial fascia and subcuta-

neous tissue of the abdominal wall. Two more cancer patients (9%) died within the 6-month follow-up period.

The mean (± SD) cost of one TISS point was $31 (± 2) and the total cost of intensive care for the (23 surviving) gynaecological patients was $154,969. This accounted for 0.28% of all costs incurred by the intensive care offered in our hospital. Consequently, the mean cost of ICU treatment was $7044 per gynaecological patient.

**Key messages**

- Few gynaecological patients develop complications requiring intensive care.
- Malignancy and comorbidities increase the risk.
- The length of stay is usually short.
- The mortality is not predicted by the APACHE II score.

## Discussion

The need for gynaecological critical care was infrequent, and overall the results of this study give a somewhat pessimistic picture of clinical outcome, with 26% mortality within 6 months. Most of the women who ended up in intensive care had undergone surgery and were classified as being at high risk, reflecting the fact that the risk of serious morbidity is especially relevant to those judged to be at high risk because of gynaecological malignancy or pre-existing medical disorders. Mortality for cancer patients admitted to ICUs have been reported to range from 40% to 80% as regards solid tumors [9]. A marked association was also observed in our patients between postoperative haemorrhage and need for intensive care. Urinary and gastrointestinal tract injuries during gynaecological procedures appeared to be relatively common in cancer surgery and they accounted for almost a tenth of all admissions. The validity of the current results is high, since the study presents a regional outcome, avoiding the selection bias inherent in multicentre studies. Another advantage is that all patients in the referral population requiring intensive care were included in the study. The mean length of time of intensive care required was of the order of 5 days and the mean cost of treatment of each critically ill woman in the ICU was of the order of $7044, without including ancillary costs incurred by treatment in the hospital ward.

In this study, the frequency of gynaecological critical care was 2.3 per 1000 women undergoing major surgery. However, in a clinical setting it is difficult to compare frequencies as such, since indications for admission differ considerably according to the availability of facilities offering advanced in-patient gynaecological care. Accordingly, whatever the level of care, a severe postoperative haemorrhage may threaten the life of a women, without subsequent need for intensive care. However, we recorded no postoperative mortality with ward care alone, and therefore the level of care appears to have been appropriate. On the other hand, this kind of study cannot fully answer the question of what would have happened without the possibility of intensive care.

Massive postoperative haemorrhage is still a major cause of severe morbidity in gynaecological care, but within the subgroup of critically ill patients, gynaecological malignancy is a major cause of in-hospital death. A delay in the correction of hypovolaemia, in the diagnosis and treatment of defective coagulation or in the surgical control of bleeding are the avoidable factors in most postoperative near-miss cases caused by haemorrhage. A multidisciplinary team involving a gynaecologist, anaesthetist and haematologist best manages these rare complications. Early diagnosis and treatment of patients at high risk may also curtail potentially grave consequences of severe infections. Primary repair of urinary and gastrointestinal tract injuries is most likely to be successful if done at the time of injury. Patients with pre-existing medical conditions, such as cardiovascular and respiratory disorders, might benefit from improved preoperative evaluation of pulmonary function and a pulmonary rehabilitation programme to reduce the risk of respiratory failure. On the other hand, anaesthesia-related severe morbidity was not seen.

The results of this study indicate that the reasons for and frequency of critical care have not changed greatly over the past few years. On the other hand, we acknowledge that admission and discharge criteria may change over 7 years, even when the same physicians are making decisions. Similarly, the decision to not admit a severely ill patient who is beyond surgical treatment or who has progressive terminal disease may change. Furthermore, the decision to proceed to surgery in patients with, for example, cardiovascular disease, a decision outside the purview of the intensivists, may well change over time, thereby influencing the frequency of admissions. Finally, the current study does not include severely ill patients seen elsewhere who qualified for admission for intensive care at Kuopio University Hospital but died before they reached the unit.

## Conclusions

Our data show that the need for intensive care in gynaecology often occurs in cancer patients. Although the need for intensive care is often unforeseeable and unavoidable, postoperative haemorrhage and pre-existing medical disorders are often related to subsequent severe morbidity. Thus, in certain patients presenting with conditions placing them in a high-risk category, clinical suspicion, advanced preparation and timing of operation may decrease the severity of a developing event. When a gynaecological patient needs intensive care, the length of stay is usually short. Capuzzo *et al.* [10] reported that after discharge from hospital, most general patients who had been admitted to the ICU returned to their preadmission physical activity and social status, and this finding also applies to the surviving gynaecological patients in

the present study. However, the presence of malignancy may contribute to death in a way not predictable by the APACHE II score, but this scoring system has not been validated for gynaecological patients and the accuracy of the score in gynaecological patients needs further clarification. Overall, the information obtained in this study may be useful not only for counselling purposes but also when allocating resources. Of course, the need for intensive care should not be the only outcome measure considered in the quality of gynaecological care, but it must be one of the most important ones.

## Competing interests

None declared.

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