Effect of the ‘Enhanced Recovery After Surgery Protocol’ on the workload of nurses in cardiac patients

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Abstract
The aim of the study was to compare the workload of nurses in patients after cardiac surgery with minimal access, anaesthesia standard and according to the ‘Enhanced Recovery After Surgery Protocol’ (ERAS protocol). A quantitative descriptive design was used. The study included a group of 100 patients with mitral valve disease in a Cardiac Surgery Intensive Care Unit (ICU) in Poland. The research project lasted 7 months. The nurses’ workload was assessed in accordance with the guidelines of NAS scale. The average age of cardiac surgery patients studied was 54.9 ± 14.38. In the studied group of cardiac surgery patients there were 48% women and 52% men.

The average workload of nurses in the ERAS group in NAS scoring on day 0 of daily duty was 67.5 ± 2.97. The average workload of nurses in the ERAS group in NAS scoring on day 1 of daily duty was 48.6 ± 2.85. The average workload of nurses in the ERAS group in NAS scoring on day 2 of daily duty was 48.6 ± 2. Patients who were anesthetised according to the ERAS protocol required less labour than standard anesthetised patients. The workload for patients anaesthetised according to the ERAS protocol is lower compared to the workload on standard anesthetised patients.

Keywords: ERAS protocol (‘Enhanced Recovery After Surgery Protocol’); NAS (Nursing activities score); nurses

Introduction
Intensive Care (IC) is not only associated with treatment, but also with intensive nursing care. It is based on 24-hour observation and analysis of the dynamics of clinical changes in the patient’s condition. The activities carried out by nurses are independent and characteristic of this profession. Whenever dependent activities are mentioned, this means activities involving the execution of physicians’ orders and requests. Co-dependent activities include cooperation with members of an interdisciplinary team (Wołowicka and Dyk, 2001). While both the TISS-28 (Therapeutic Intervention Scoring System) and NEMS (Nine equivalents of nursing manpower use score) scales have been adapted to Polish working conditions, they are not used universally in everyday clinical practice (Miranda et al., 1996; 1997; 2003). The quality of care is determined by many factors, including human resources and staff qualifications. The qualifications in question are necessary for the proper performance of one’s duties at the workplace. There are no legal regulations in Poland that provide a detailed specification of the ICU nursing staff. In our daily work we do not encounter the use of special tools for the purpose of planning the nursing staff. The research on the planning of nursing manpower has given rise to the idea of developing tools which should allow every ICU to estimate its staffing needs (Miranda et al., 1996; Smereka and Kiibler, 1998; Wysokiński, 2006). Many studies have shown that insufficient number of nurses has an adverse impact on mortality, infections and general patient safety (Aiken et al., 2002; Rafferty et al., 2007; Seago et al., 2006; Zingg et al., 2015). The aim of the study was to compare the workload of nurses in patients after cardiac surgery with minimal access, anaesthesia standard and according to the ERAS protocol.

Materials and methods
Design and participants
The NAS (Nursing activities score) scale is used to assess the workload of nurses in terms of demand for nursing care in intensive care units (Miranda et al., 2003). This scale was developed by a team of scientists who had previously conducted their research on TISS-28 and NEMS score systems. The NAS scale allows one to examine the time a nurse spends on patient...
The research was conducted in accordance with Resolution No. Ethical approval. The study included a group of 100 patients – 50 were adminis-
ted under standard anaesthetisation and 50 anaesthetised according to
the Enhanced Recovery After Surgery Protocol (ERAS) (Suppl. 1). Both
groups of patients were hospitalised in the Department of Intensive Cardiac Surgery Care after minimal access valve surgeries, from 1 November 2017 to 31 May 2018. During the study on the nurses’ workload, 38 nurses working in the Department of Intensive Cardiac Surgery Care were invited to participate in the study. Patients who qualified for the study were selected alternately – one patient was qualified for ERAS anaesthesia and another for standard anaesthesia. Both patients and nurses received a form to give informed consent for participation in the study. The study was prospective. Nurses were also selected randomly, depending on the duty performed. During working hours they filled in the document-
tation (once during duty), which included NAS scale. The NAS scale is used as a standard for patient documentation in the Department of Cardiac Surgery. After each duty shift, the number of points collected in all patients in the ward was recorded, and the points were then summed up and divided by the number of nurses working on a given shift.

Data collection
The study included a group of 100 patients – 50 under standard anaesthetisation and 50 anaesthetised according to the ERAS protocol. Both groups of patients were hospital-
ized in the Department of Cardiac Surgery Intensive Care after a valve surgery with minimal access, from November 1, 2017 to May 31, 2018. The table below shows the main differences between the anesthesia protocols. Reporting of the study find-
ings adheres to the CONSORT checklist; see Suppl. 2.

Ethical approval
The research was conducted in accordance with Resolution No. 2018/04/04/04 of the University of Rzeszów Bioethics Com-
mittee.

Results

General characteristics
The study group consisted of 100 patients after a cardiac sur-
gery in the ICU ward; half of which had been anaesthetised according to the ERAS protocol and another half anaesthetised in line with the standard procedure. The description was car-
ried out separately for each patient group. In the studied group of cardiac patients, 48% were women and 52% men. The distri-
bution of women and men in groups of patients anaesthetised with the ERAS protocol and standard procedure was similar ($\chi^2 = 0.16; p = 0.68$). The differences, however, were not sta-
tistically significant. The age of all patients in the study group was from 18 to 81 years with a range of 63 years. The mean age of cardiac patients was 54.9 ± 14.38. The median age in the ana-
lysed group was 57 years. In this case, statistical significance

Nursing workload on the NAS scale
Our analysis showed statistically significant differences in NAS scores between day duty day 0 and the other day and ni-
ght duty days. The NAS score was significantly higher for day duty than during the days that followed the procedure. Statis-
tical significance applied to all duty days (Fig. 1).

On duty days following the procedure, significant differ-
ences were found in NAS scores between day and night duty days. On day 0 the NAS score on night duty was significantly higher than the NAS score on night duty (Fig. 2).

On day duty day 1, the NAS score was below the norm, but significantly lower for ERAS protocol patients than for standard anaesthetised patients ($p < 0.00001$). On day duty day 2, the NAS score was below the norm, but significantly lower for ERAS protocol patients than for standard anaesthet-
sed patients ($p < 0.00001$). As the table below shows, NAS is therefore a good instrument to appraise the impact of the implementation of a new technology/procedure in the ICU, at least concerning the cost and the consumption of the nursing resource (Table 1).
Fig 1. A comparison of average NAS scores for night and day nursing duties on individual days. \( p \) – significance level

![Graph showing NAS scores for night and day nursing duties on individual days.](image)

Fig. 2. A comparison of average NAS scores for night and day nursing duties on individual days. \( p \) – significance level

![Bar chart comparing NAS scores for night and day nursing duties on individual days.](image)

### Table 1. Comparison of patient results in both anesthesia groups on subsequent days

<table>
<thead>
<tr>
<th>NAS</th>
<th>ERAS protocol</th>
<th>Standard anaesthesia</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium No. Pts</td>
<td>Mean NAS Score</td>
<td>Medium No. Pts</td>
</tr>
<tr>
<td>Day 0</td>
<td>day duty</td>
<td>50</td>
<td>67.5 + 2.93</td>
</tr>
<tr>
<td></td>
<td>night duty</td>
<td>50</td>
<td>54.9 + 2.83</td>
</tr>
<tr>
<td>Day 1</td>
<td>day duty</td>
<td>2</td>
<td>48.8 + 2.85</td>
</tr>
<tr>
<td></td>
<td>night duty</td>
<td>1</td>
<td>47.9 + 2.83</td>
</tr>
<tr>
<td>Day 2</td>
<td>day duty</td>
<td>1</td>
<td>48.6 + 2.0</td>
</tr>
<tr>
<td></td>
<td>night duty</td>
<td>1</td>
<td>46.2 + 0.5</td>
</tr>
<tr>
<td>Day 3</td>
<td>day duty</td>
<td>–</td>
<td>–</td>
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<tr>
<td></td>
<td>night duty</td>
<td>–</td>
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</tr>
</tbody>
</table>
Discussion

Our study explored how the type of anaesthesia influenced the nursing workload at ICUs. For this purpose, we used the NAS scale. The NAS scale was first published in 2003 by Miranda et al. (Miranda et al., 2003). In 2007 this scale was validated for Polish purposes by Dyk and Cudak (2008). As part of their study, they analysed five intensive care units in Poland. Three of them were secondary referral hospitals, while two were tertiary referral hospitals. The study covered a group of 314 patients hospitalised at ICUs (Dyk and Cudak, 2008). They analysed the data of 100 patients of a tertiary referral hospital. The data were collected for 7 months. Male participants were in the majority (52% vs. 48% female participants). They were randomly assigned to ERAS anaesthesia (50%) and, also randomly, to standard anaesthesia (50%). The average age of patients in the Piroze ICU was 60.3 ± 13 years (Davierwala et al., 2013). In our study patients were aged 18 to 81.

The study revealed that the nursing workload decreased gradually over the ICU hospitalisation period. The highest workload was found on day 0. A prolonged ICU hospitalisation involved a range of adverse events such as: hospital-acquired infections and mental strain on the personnel and patients. Bernat Adell et al. (2005) and Li et al. (2018) have proven that a strong relationship exists between the NAS workload and the hospitalisation of patients.

In our study, on day 0 the NAS score on day duty was significantly higher than the NAS score on night duty. This could be explained by the activities performed by nurses during the admission of post-operative patients (arterial-blood gas tests, laboratory tests, medical documentation, blood and blood product transfusions in cases of increased drainage, follow-up tests every hour for the first six hours after the surgery). Keene and Cullen (1983) also noted this relationship in their studies.

In our study, we noted that the nurses who provided care to standard anaesthetised patients scored above 100 on the NAS scale. This means that more than one nurse should handle the care of one patient. In the case of ERAS protocol patients, the score was lower by approximately a half, meaning that the nurses who were responsible for these patients could spend half of their working time helping in providing care to other patients. Due to its design and items, the NAS scale allows a more detailed investigation of nursing activities, while also providing more information on patients and the workload they require.

The scales which measure the nursing workload involve certain limitations, and these have significant implications for the studies. The NAS scale covers over 40% more nursing activities than the TISS-28 and NEMS scales. Measuring typically nursing-related activities, the scale provides what was missing in other scales, and what limited the applicability of these scales in workload studies (Hugonnet et al., 2007; Miranda et al., 1996; Penoyer, 2010). The average time it takes a nurse to complete the nursing intervention questionnaire is 5–6 minutes. Hence, it could be an everyday tool to measure demand for the nursing personnel. The NAS scale relates not only to clinical activities, but also to the care activities involving nurses. A systematic assessment of the care provided by therapeutic teams to patients helps to improve the overall healthcare system and its individual components (Wasilewski, 2008). Branch-Elliman et al. (2013) conducted studies which found that nurses did not delay their tasks due to patients requiring an increased workload. For 29% of the respondents, some delays were attributable to factors unrelated to the patient’s body (e.g., ventilator set-up).

Our study showed that despite the ERAS protocol being in place, more nurses were needed to staff ICUs. Although nurses devoted an average of half their working time to ERAS patients, it should be noted that some standard anaesthetised patients required about 100% of nursing work time. Studies by researchers from other countries found that an average of 72.8% of ICU nurses were given an excessive workload (Camuci et al., 2015; Giakoumidakis et al., 2012; Nogueira et al., 2013; Stafseth et al., 2011). The maximum workload was recorded in Norway at 101.8%. Average workloads were recorded in Poland (83.0%), Greece (64.59%), Egypt (57.1%), Brazil (54.0%) and the Netherlands (51.0%). According to other studies, ICU workload depends on both the specific conditions of the ICU and the patients’ conditions [33, 34, 35, 36]. The leading studies on nursing workload were conducted by Needelman (Cullen et al., 1974). In intensive care, patient qualification for surgery and nursing workload reduction are both important aspects of patient care (Fruhiger, 1999; Keene and Cullen, 1983; Miranda et al., 1996; Norrie, 1997). ICU nursing activities accounted for similar workloads on the NAS scale. Harrison and Nixon compiled studies which used data on the time spent by nurses on individual activities (Norrie, 1997). The largest percentage of their work time was associated directly with providing care. Other studies found that the provision of direct care accounted for 50% of nursing work time, while 10% was spent on non-care duties. According to Norrie (1997), 60% of nursing work time was spent on direct care, 22% on patient evaluation and 10% on indirect activities. Furthermore, in his study Harrison found that nurses spent 80% of their work time on patient evaluation, monitoring and position changes, and on keeping records of their nursing activities.

In global studies, we did not find information on the workload of nurses in anesthetized patients according to the ERAS protocol. There are studies on patient mortality and the workload of nurses (Margadant et al., 2020). However, there are no global reports on patient mortality and the workload of nurses in the ERAS group. This study is the first in the world.

Conclusions

The nursing workload associated with ERAS patients is lower than that associated with standard anaesthetised patients. The duration of both respiratory support and hospitalisation at ICUs depends on the type of anaesthesia. Statistically significant differences were found in NAS scores between care provided to ERAS patients and care provided to standard anaesthetised patients. The ERAS protocol has a positive effect on patient safety at all its stages.

Conflict of interests

The authors declare no conflict of interests.
Vliv protokolu „Enhanced Recovery After Surgery Protocol“ na pracovní zátěž zdravotních sester u kardiologických pacientů

Souhrn
Cílem studie bylo porovnat pracovní zátěž u pacientů po operaci srdce s minimálním přístupem, standardní anestezíí a podle protokolu ERAS. Byla použita kvalitativní popisná metoda. Studie zahrnovala skupinu 100 pacientů s onemocněním mitrálního chlónového na kardiologické jednotce intenzivní péče (ICU) v Polsku. Výzkumný projekt trval 7 měsíců. Pracovní zátěž sester byla hodnocena v souladu s měřítky NAS. Průměrný vek studovaných pacientů byl 54,9 ± 14,38. Skupina pacientů zahrnovala 48 % žen a 52 % mužů.

Průměrná pracovní zátěž sester ve skupině ERAS v NAS skoringu v den 0denní povinnosti byla 67,5 ± 2,97. Průměrná pracovní zátěž sester ve skupině ERAS v NAS skoringu v den 1denní povinnosti byla 48,6 ± 2,85. Průměrná pracovní zátěž sester ve skupině ERAS v NAS skoringu v den 2. denní povinnosti byla 48,6 ± 2. Pacienti s anestezíí podle protokolu ERAS vyžadovali méně práce než standardní pacienti s anestezíí. Pracovní zátěž u pacientů s anestezíí podle protokolu ERAS je ve srovnání s pracovní zátěží u standardních pacientů s anestezíí nižší.

Klíčová slova: ERAS („Enhanced Recovery After Surgery Protocol“); NAS (Nursing activities score); zdravotní sestry

References


