SHORT COMMUNICATION

The impact of team familiarity on surgical outcomes in gynaecological surgery

Andreas Obermaira, Marko Simunovicb and Monika Jandab,c

aFaculty of Medicine, Queensland Centre for Gynaecological Cancer, The University of Queensland, Brisbane, Australia; bInstitute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane, Australia; cCentre for Health Services Research, The University of Queensland, Brisbane, Australia

Introduction

Complex surgery requires high level, interpersonal interactions from multidisciplinary team members in an operating room environment (Cohen and Bailey 1997). Team members need to work together and create a shared mental model of the knowledge and role of each person involved in surgery (Wegner 1995). A body of work exists that evidences the crucial importance of teamwork and communication in the operating theatre for patient safety (Leonard et al. 2004; Lingard et al. 2004). In a human factors-focused review of adverse events in the operating theatre, flow disruptions caused by impaired teamwork and communication failures were identified as the common root causes (Shouhed et al. 2012). Working with new or unfamiliar teams could significantly interrupt the flow of steps in a surgical procedure (Patterson et al. 2016; Henaux et al. 2019), and has been described as a key contributor to stress and burnout in surgery (Swendiman et al. 2019). Previous studies have shown reductions in the length of operating time when team familiarity is high and fewer complications towards the end of a training term (Kurmann et al. 2014). In colorectal cancer surgery, recovery was better for patients where the dedicated operating team was closely linked to an Enhanced Recovery after Surgery network (Grant et al. 2018). However, most of these previous assessments used indirect measures of the quality of team cohesiveness. This project evaluated the association of surgeons’ own rating of team familiarity with the risk of surgical complications in gynaecological surgery.

Materials and methods

The data of 14,482 patients who had had gynaecological surgery between January 2005 and June 2017 was available. As all of the data was collected in a non-identifiable format, the Royal Brisbane and Women’s Hospital Human Research and Ethics Committee exempted the study from formal review (HREC/18/QRBW/31).

The data collected in the surgical outcomes online database included the patient demographics, pre-existing medical co-morbidities (computed into Charlson comorbidity index) (Charlson et al. 1994), body weight and height which were used to compile the body mass index (BMI), American Society of Anaesthesiologists (ASA) score, surgeon’s role (assisting, supervised, unsupervised case, teaching case), surgical procedure, general adverse events (e.g. blood loss) and the procedure-specific adverse events (e.g. ureter injury). Familiarity of the team was assessed using a five-point Likert scale completed by the lead surgeon typically at the conclusion of the surgical procedure. The scale was developed in collaboration with a group of users of the online database, who reviewed the question for face value, and piloted it, before it was released to be included in the database online forms as one of the optional data fields.

The primary outcome was the incidence of one or more adverse events (yes, no) following surgery. Only data sets with complete mandatory data fields were extracted for statistical analysis. Pearson χ² tests were used to assess factors associated with adverse events. Any variable with p < .10 following bivariate analysis was included in a multivariable logistic regression model. Statistical analyses were performed using SPSS, version 24.0 (IBM Corp), and 2-sided p < .05 was considered to be statistically significant.

Results

From 14,482 records related to the four surgical procedures of interest (hysterectomy, salpingo-oophorectomy, resection of endometriosis and pelvic floor repair), 7,775 records were excluded because they were incomplete. Incomplete records are those still awaiting the surgeon to complete all data entry post-surgery and mark the record off as complete. Overall, 672 of the remaining 6,707 patients (10.0%) developed at least one surgical adverse event (916 total adverse events). Across all procedures, the proportion of adverse events differed significantly by the familiarity of the team category (χ² = 20.9; p = .01); from 8.2% for procedures where the surgeon scored team as ‘very familiar’, to 16.2% for procedures with a ‘not familiar’ team, respectively. In bivariate analyses, other than familiarity of the team, patients’ comorbidities, procedure other than resection of endometriosis, ASA score, and patients’ BMI category were also associated...
with adverse events (Table 1). In the multivariable logistic regression model, familiarity of the team remained independently associated with surgical adverse events, when adjusted for age, comorbidities, ASA score and type of procedure, while BMI was no longer significantly associated. Compared to very familiar surgical teams, the odds of having an adverse events were about 30% higher for somewhat familiar teams, and double for unfamiliar teams (Table 1). When assessing individual procedures, a significant association was observed between team familiarity and the incidence of adverse events in hysterectomy ($p < .01$). However, in salpingo-oophorectomy, endometriosis and pelvic floor repair only a small number of surgeries were performed in an unfamiliar team environments and no significant association with adverse events was observed (data not shown).

**Table 1.** Patient characteristics, clinical characteristics, and adverse event outcomes.

| Variable                        | No adverse event ($n = 6035$ (90%)$^a$) | One or more adverse event ($n = 672$ (10%)$^a$) | Odds Ratio (95% CI) | $p$ value |
|---------------------------------|------------------------------------------|--------------------------------------------------|---------------------|-----------|
| **Patient characteristics**     |                                          |                                                  |                     |           |
| Age ($n = 6707$)                 |                                          |                                                  |                     |           |
| <29                             | 530 (88.8)                               | 67 (11.2)                                        | Reference           | .000      |
| 30–39                           | 1093 (89.2)                              | 132 (10.8)                                       | 0.85 (0.61 to 1.17) | .317      |
| 40–49                           | 1815 (89.8)                              | 206 (10.2)                                       | 0.66 (0.47 to 0.92) | .014      |
| 50–59                           | 1146 (91.7)                              | 104 (8.3)                                        | 0.47 (0.33 to 0.68) | .000      |
| 60–69                           | 870 (90.9)                               | 87 (9.1)                                         | 0.47 (0.32 to 0.70) | .000      |
| >69                             | 587 (88.4)                               | 76 (11.6)                                        | 0.57 (0.37 to 0.87) | .009      |
| ASA ($n = 6707$)                 |                                          |                                                  |                     |           |
| Normal healthy patient (1)      | 3948 (90.9)                              | 394 (9.1)                                        | Reference           | .029      |
| Mild systemic disease (2)       | 1620 (89)                                | 224 (11)                                         | 1.18 (0.96 to 1.44) | .109      |
| Severe systemic disease (3–5)   | 267 (83.2)                               | 54 (16.8)                                        | 1.64 (1.12 to 2.39) | .010      |
| Comorbidities index ($n = 6707$)|                                          |                                                  |                     |           |
| 0                               | 5101 (90.6)                              | 530 (9.4)                                        | Reference           | .003      |
| 1                               | 520 (85.5)                               | 88 (14.5)                                        | 1.47 (1.11 to 1.95) | .007      |
| 2                               | 325 (91.3)                               | 31 (8.7)                                         | 0.83 (0.55 to 1.23) | .351      |
| 3 or more                       | 89 (79.5)                                | 23 (20.5)                                        | 1.87 (1.10 to 3.15) | .019      |
| BMI ($n = 3679$)                 |                                          |                                                  |                     |           |
| <25                             | 1326 (92)                                | 115 (8.0)                                        | –                   | –         |
| >25–35                          | 970 (89.6)                               | 113 (10.4)                                       | –                   | –         |
| >30–35                          | 577 (90.9)                               | 58 (9.1)                                         | –                   | –         |
| >35                             | 457 (87.9)                               | 63 (12.1)                                        | –                   | –         |
| **Clinical characteristics**     |                                          |                                                  |                     |           |
| Team familiarity ($n = 6707$)    |                                          |                                                  |                     |           |
| 5- Very familiar                | 2488 (91.8)                              | 222 (8.2)                                        | Reference           | .003      |
| 4- Familiar                     | 1739 (88.4)                              | 229 (11.6)                                       | 1.41 (1.16 to 1.70) | .001      |
| 3- Somewhat familiar            | 1489 (89.4)                              | 176 (10.6)                                       | 1.28 (1.04 to 1.58) | .021      |
| 2- Minimally familiar           | 231 (89.2)                               | 28 (10.8)                                        | 1.30 (0.85 to 1.99) | .221      |
| 1- Not familiar                 | 88 (83.8)                                | 17 (16.2)                                        | 2.06 (1.20 to 3.55) | .009      |
| Procedure ($n = 6707$)          |                                          |                                                  |                     |           |
| Resection of endometriosis      | 890 (94.8)                               | 49 (5.2)                                         | Reference           | .000      |
| Pelvic floor repair             | 1494 (90.7)                              | 153 (9.3)                                        | 2.61 (1.77 to 3.84) | .000      |
| Hysterectomy                    | 2453 (90.3)                              | 264 (9.7)                                        | 2.43 (1.71 to 3.46) | .000      |
| Salpingo-oophorectomy           | 1198 (85.3)                              | 206 (14.7)                                       | 3.62 (2.58 to 5.08) | .000      |
| Primary surgeon ($n = 6554$)    |                                          |                                                  |                     |           |
| Specialist                      | 5155 (90)                                | 570 (10)                                         | –                   | –         |
| Trainee                         | 739 (89.1)                               | 90 (10.9)                                        | –                   | –         |
| Role in surgery ($n = 3045$)    |                                          |                                                  |                     |           |
| Teaching a trainee              | 33 (84.6)                                | 6 (15.4)                                         | –                   | –         |
| Done unsupervised               | 217 (88.9)                               | 27 (11.1)                                        | –                   | –         |
| Done supervised                 | 1943 (88.2)                              | 259 (11.8)                                       | –                   | –         |
| Assist                          | 508 (90.7)                               | 52 (9.3)                                         | –                   | –         |

Variables included in the multivariable model include: familiarity of the team, comorbidities index, main procedure, American Society of Anaesthesiologists (ASA) score and age group.

– designates terms not included in the model.

OR: odds ratio.

CI: confidence interval.

$^a$Adverse event total for variables included in multivariable model.

**Discussion**

A significant association between the familiarity of the surgical team as rated by the primary surgeon and the risk of adverse events in gynaecological surgery was found in this study. In analyses adjusted for multiple other factors known to influence surgical outcomes such as ASA score and BMI, the likelihood of an adverse event was double (OR 2.06) in ‘not familiar’ compared to ‘very familiar’ teams. A linear pattern of decreasing risk of adverse events in more familiar teams was evident in three of the four individual procedures studied (hysterectomy, resection of endometriosis; salpingo-oophorectomy), although significant associations were only observed in hysterectomy, likely due to small number of procedures in some categories. Other reasons may include...
differences between procedures in complexity, time required to complete surgery or need for special instrumentation, factors which should be assessed in future research.

This study is unique in that the estimate of team familiarity was collected directly from the lead surgeon. In previous studies, team familiarity was operationalised in many different ways, most commonly based on the length of time that a team was rostered together, or observational methods (Patterson et al. 2016; Henaux et al. 2019). With regards to outcomes, adverse events was uncommonly used, while studies often assessed the impact of team familiarity on the length of surgery, with shortened duration potentially indicating smooth proceedings (Ergina et al. 2009). Operating time was significantly shorter in teams with prior collaborations compared to teams with little or no prior collaborations (Maruthappu et al. 2016). Postoperative complications were reduced from 54% within the first month to 34% within the last month of a surgical training rotation (Kurmann et al. 2014). However, when teamwork and communication training was introduced to improve the human factor collaboration, it led to improved outcomes only in three out of nine reviewed studies (Sun et al. 2018). The mechanisms by which familiarity of the team may impact better surgical outcomes may be wide ranging including technical, communication and interpersonal factors, and clearly need to be better understood (Shouhed et al. 2012). Recent work highlighted the importance of organisational factors and psychological safety allowing each member of the surgical to speak up or raise concerns with aspects of the surgery (Swendiman et al. 2019). This safety behaviour may be crucial for the prevention of adverse events and may be more common in familiar teams.

In contrast to other studies that used more extensive questionnaires or observational methods to assess team familiarity (Leonard et al. 2004; Lingard et al. 2004; Henaux et al. 2019), this study is limited by using a single item completed by the surgeon to measure the outcome.

This study has shown that team familiarity as rated subjectively by the lead surgeon is significantly associated with the development of surgical complications. Prospective studies to determine the impact of team composition and degree of shared mental model (experience, time working together, quality of communication, knowledge of each person’s competencies), rostering, and perceptions of a familiar and supportive work environment on critical patient outcomes such as adverse events are warranted (Wegner 1995; Hirst et al. 2019).

**Disclosure statement**

The authors have not published, posted, or submitted any related papers from the same study.

MJ is a shareholder and AO is the founder and managing director of SurgicalPerformance Pty. Ltd., an Australian, private company that provided the online anonymous database platform for the collection of the data for this project. AO is a consultant for Medtronic and The OR Company. AO also receives travel grants from The OR Company. MS declares no conflict of interest.

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