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OTHER PAIN (N VADIVELU AND AD KAYE, SECTION EDITORS)

Surgical Flow Disruptions, a Pilot Survey with Significant Clinical Outcome Implications

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Abstract

Purpose of Review Surgical flow disruptions (SFD) are deviations from the progression of a procedure which can be potentially compromising to the safety of the patient. Investigators have previously demonstrated that SFDs can increase the likelihood of error. To date, there has been no investigation into flow disruptions through the eyes of clinicians in the operating room. This study, therefore, attempted to better understand SFDs and their impact from the perspective of operating room team members.

Recent Findings After Institutional Review Board approval, a survey was sent to operating room team members including surgeons, anesthesia providers, nurses, and surgical technologists. The survey was developed to assess the perceived frequency and consequences of SFDs, and the ability to report and perceive the efficacy of reporting to management. Among 111 survey participants, 65% reported that surgical flow disruptions happen either "several times a day" or "every procedure." Forty percent ranked poor communication as the most frequent cause of SFDs. Ten percent reported equipment failure was the most frequent cause of SFDs. Respondents who identified as attending surgeons felt impacts on patient safety and staff burnout was the most likely consequence of SFDs. Scrub technicians and nurses felt that economic consequences were the most likely result. Forty-four percent did not feel reporting led to effective change. Thirty-five percent did not believe they could report issues without adverse consequences.

Summary Flow disruptions represent patterns or accumulations of disruptions which may highlight weak points in surgical systems and potential causes of staff burnout and medical error. The data in the present investigation demonstrate that OR team members recognize surgical flow disruptions are an important issue and believe poor communication and equipment problems are a significant factor. Our data additionally suggest the groups surveyed do not feel safe or productive in reporting flow disruptions.

Keywords Surgical flow disruptions · Operating room · Anesthesiologist · Surgeon · Nurse

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Introduction

Psychologist Mihaly Csikszentmihalyi described flow with respect to complex work as a loss of consciousness of self, a distorted sense of time, and focus free from outside distractions where individual performance is observed to be at its peak [1••, 2]. The idea of flow can also be connected to mindfulness or being fully present and attentive to the task or moment. Being fully present and reaching one's "flow" have been linked to better clinical decision making due attention to the present moment, improved clinician mental health, and reduced burnout [3]. As a complex activity, surgery possesses natural flow when procedure progresses with ease and fluidity. With surgical systems in mind, the flow has been defined as the ease and fluidity to which a procedure progresses.

Although individual flow disruptions may not lead to imminent patient danger, patterns can provide a window or surrogate measure to both latent error and potential weaknesses in surgical systems.

Previous studies of flow disruption during surgical procedures have used trained observers, often a medical student or research assistant, to tally and categorized flow disruptions as they occur [4, 5••, 6, 7]. Our study, in contrast, was designed to improve the understanding of operating room team members' impression of flow disruptions and their causes and consequences. The survey used in this study was developed to validate previous studies and to determine if various team members viewed flow disruptions differently. Additionally, the present investigation attempted to understand better whether if reporting flow disruptions to surgical services leadership or management was considered helpful and if a team member felt they were safely able to report.

Methods

The present investigation utilized a survey online using Survey Monkey®. The study consisted of 16 questions and space for open response comments. The survey questions were a combination of multiple choice, categorical ranking, and Likert scale styled to queries. At the end of the survey, there was a space for comments or observations regarding surgical flow disruptions. The survey was contextualized with only the following definition of surgical flow disruptions written by Wiegmann and colleagues: "Surgical flow disruptions are deviations from the natural progression of a procedure that potentially compromise the safety of the operation" [5••]. The survey was distributed to all general surgery residents, faculty and attending physicians, nurses, and surgical technologists through departmental email lists made available by individual department heads of three different academic medical centers in the gulf south. This study and all survey material were deemed exempt from review by the Tulane University and Louisiana State University institutional review boards.

The questions for the survey were based on those used in previous studies exploring surgical workflow disruptions. We identified areas discussed by previous research groups including team and interdisciplinary communication, equipment or technology, and interruptions from sources physically outside the operating room. We also described previously studied consequences including patient safety, waste and financial cost, and burnout. Data was collected from the survey and converted to a spread sheet. Descriptive statistics were used to understand any trends that may exist.

Results

Of the 130 individuals who received the survey, 111 (85%) responded. The largest group of respondents, 44 (41%), reported being between the ages of 25–34, while 41 (38%) reported being between 35 and 44. Female respondents made up 36% (40). Respondents who identified as "Nurse Anesthetists" made up 32% of the respondents. The majority, 65 (60%), reported working in the operating room more than 30 h a week.

When the definition of surgical flow disruption established by Wiegmann and colleagues [5••] was given, 31.5% (29) of respondents, reported surgical flow disruptions "occur several times a day." Cases are slowed down daily according to 37% (34) respondents. Of the respondents, 57% (50) reported procedures being canceled related to flow disruptions on a weekly basis.

When asked to rank categories of flow disruptions from most frequent to least frequent, respondents ranked poor communication between teams, not having the correct equipment available, and technology failure as the top three causes of disruption, in that order.

When stratified by reported position, half of the attending surgeons reported SFDs occur several times a day while only one-third of anesthesiologists responded this way. Attending surgeons felt that equipment or technology failure was the most common causes of surgical flow disruptions while anesthesiologists ranked poor communication as the top cause.

Forty-five percent of respondents disagreed or strongly disagreed that surgical flow disruptions are an inevitable part of any procedure. This implies that most respondents recognize SFDs as a regular occurrence, but one that is potentially preventable. Twenty-five percent agreed that surgical flow disruptions are a routine part of any procedure. Most respondents (65%), agreed with the statement that surgical flow disruptions are, in general, avoidable events. Eighty-two percent felt that surgical flow disruptions directly affect the patient. In the case that a flow disruption was observed and was severe enough to require the attention of administration 36% felt that they could not report these events without personally experiencing adverse effects.

Discussion

Flow disruptions have been previously investigated, but, to our knowledge, this is the first study of this size that directly asked surgery team members for their detailed thoughts and perceptions on surgical flow disruptions rather than having an outside observer collect the data in real time. The present investigation surveyed clinicians who work in the operating room to gain first-hand insight into how surgical flow disruptions are perceived and to build upon previous findings on the

subject. Additionally, the study attempted to see if the conclusions from an outside observer resonated consistently with those who experience these disruptions on a daily basis. All respondents were clinicians actively working in the operating room. The responses represent their current perception and understanding of surgical flow disruptions and the consequences that follow. The study attempted to understand the current level of knowledge, the perceived rate, and if the working environment encouraged reporting these interruptions (SFD) to progress toward improvement.

In 2007, Healey et al. using a trained observer recorded a mean of 0.45 flow disruptions per minute during urology procedures [4]. This study described the distractions as related to team communication, equipment or environmental issues, and procedural challenges. This group also found disruptions in workflow relating to outside or case irrelevant conversations, work environment issues, telephone calls, and equipment failures [8]. In 2007, Wiegmann and team recorded errors and disruptions in flow during 31 cardiothoracic procedures. The data was classified and analyzed by a team of human factors experts. Similar to previous findings, Wiegmann's group described that the flow disruptions most often related to communication breakdown. This group concluded communication-related disruptions were the most reliable predictor of error and found that communicated accounted for 52% of the disruptions. This study adds to the literature by presenting an empirical link between flow disruptions and operating room errors [5••]. Alternatively, Sevdalis et al. reported three or four disruptive incidents per procedure [9]. The present investigation found discordance in that our responses suggest that SFDs occur only several times a day, not during every procedure. The existing literature suggests our respondents undercounted the frequency of SFDs. One possible explanation for this is that most interruptions are not perceived as significant or are so routine and ingrained in delivery that they are not perceived at all. Our evidence supports this idea. Fifty-seven percent of respondents report procedures are canceled due to flow disruptions at least once a week. This finding indicates to us that it is possible that only significant disruptions were considered and there may be an opportunity for education and awareness of the potential consequences of the accumulation of small interruptions.

As reported in previous studies, our respondents agreed that flow disruptions were most often attributed to communication breakdown. Wiegmann found that issues related to teamwork or communication breakdown were most predictive of error [5••]. A potential issue with this explanation as a cause is the variability in definition and use of the term "communication disruption." Sevdalis et al. describe two breakdowns in communication: (1) issues in coordination or (2) conversation not relevant to the current case. Although we did not specify the distinction, both of these communication breakdowns are disruptive to the current task and may likely have a similar impact, reducing focus and team concentration. Further exploration of the variation in communication breakdown would be an important aspect of a subsequent study.

Previous studies have described flow disruptions as a window or surrogate measure to both latent error and potential weaknesses in surgical systems [10]. Effort to highlight the so-called near misses and report error has been a focus since the Institute of Medicine's report *To Err is Human* [11]. Despite this focus, one of the most revealing and striking findings of our survey is that 36% of our respondents did not feel safe in reporting flow disruptions. This finding is novel to our study, but perhaps not unexpected. A major challenge to reporting is finding a balance between holding providers accountable for performance and simultaneously encouraging a reporting culture to maintain a flow of data that can be used for system improvement [12]. All three academic centers surveyed have error reporting mechanisms. Reporting near misses can provide invaluable information for proactively reducing error and preventing a similar disruption in the future. However, there may be a disconnect between the definition of flow disruptions, the perceived seriousness of a disruption, and who is "at fault." Our study highlights gaps in understanding. The previous literature demonstrates that even small disruptions can lead to significant patient care implications because if clinicians are only perceiving and catching major disruptions, they are missing the opportunity for continued quality improvement. Further, members of the healthcare team may disagree about which events constitute a near miss or reportable event, and whether reporting results in improvements or at worse retaliation. One question not asked is whether management has the education, time, or resources to use reports to effect change effectively. Although flow disruptions may not always lead to a severe event, they always represent a weakness in the system that may be avoidable.

With serious errors, blame is often introduced, and accountability is demanded. However, as seen in our data and in previous studies, SFDs occur so regularly that it is likely that operating room personnel do not recognize them as reportable events. Another possibility is that people do not want to be blamed for delays or interruptions. As stated by 32% of survey respondents, disruptions are part of every day, and 37% said they are part of every procedure. This indicates a need for culture and organizational change to recognize these disruptions as learning opportunities for improvement and not just another delay in the operating room.

Conclusion

These survey findings indicate that clinicians are aware of flow disruptions and believe disruptions are a constant problem in the operating room. The findings of this study validate findings in the literature and add additional awareness of the

differences in how various team members view flow disruptions. For example, surgeons and anesthesiologists had contrasting opinions in what the cause of most SFDs was. We attribute this to different roles in the operating room and how their specific workflow is disrupted. For example, if the desired instrument is not on the field or is not functioning, this is quite disruptive for the surgical team. However, the anesthesia team's workflow is likely not impacted. This may also account for variation in how often SFDs are perceived to occur. When trying to understand how to improve reliability in systems, this is a possible proxy measurement to keep in the quality improvement toolkit.

As with all surveys, there are limitations including sample bias and the unpredictability of who is willing to complete it. Capturing disruptions in real time has value for accurate reporting and limiting bias. However, this study provides insight into the minds of those who work in the operating room every day. To improve the current processes, insight is needed to see how our teams see and react to SFDs. This study had an excellent response rate, but our sample skewed toward nurse anesthetists and anesthesiologist. It would be speculation to explain why surgeon response rate was lower, but there is no doubt that team training techniques to reduce SFD must be inclusive of all involved. A strength of this study is that data was collected from three academic medical centers with different management, providing a broader picture than a single institution. Finally, the unique link to our survey was sent out by administrators and department chairs rather than peers who could influence how respondents choose to answer.

Compliance with Ethical Standards

Conflict of Interest David Silver, Alan Kaye, and Douglas Slakey declare no conflict of interest. Alan Kaye is a Section Editor for *Current Headache and Pain Reports*. He has not been involved in the editorial handling of this manuscript. Dr. Kaye is also a speaker for Merck.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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