Patterns of Communication Breakdowns Resulting in Injury to Surgical Patients

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BACKGROUND: Communication breakdowns are a common threat to surgical safety, but there are little data to guide initiatives to improve communication.

STUDY DESIGN: In surgeon-review of 444 surgical malpractice claims from 4 liability insurers, we identified 60 cases involving communication breakdowns resulting in harm to patients. Two surgeon-reviewers analyzed these cases to identify common characteristics and associated factors. Based on identified patterns, potential interventions to prevent communication breakdowns were developed and their potential impact was assessed.

RESULTS: The 60 cases involved 81 communication breakdowns, occurring in the preoperative (38%), intraoperative (30%), and postoperative periods (32%). Seventy-two percent of cases involved one communication breakdown. The majority of breakdowns were verbal communications (92%) involving 1 transmitter and 1 receiver (64%). Attending surgeons were the most common team member involved. Status asymmetry (74%) and ambiguity about responsibilities (73%) were commonly associated factors. Forty-three percent of communication breakdowns occurred with handoffs and 39% with transfers in the patient's location. The most common communication breakdowns involved residents failing to notify the attending surgeon of critical events and a failure of attending-to-attending handoffs. Proposed interventions could prevent 45% to 73% of communication breakdowns in this cases series.

CONCLUSIONS: Serious communication breakdowns occur across the continuum of care, typically result from a failure in verbal communication between a surgical attending and another caregiver, and often involve ambiguity about responsibilities. Interventions to prevent these breakdowns should involve: defined triggers that mandate communication with an attending surgeon; structured handoffs and transfer protocols; and standard use of read-backs. (J Am Coll Surg 2007;204: 533–540. © 2007 by the American College of Surgeons)

Many factors influence surgical outcomes. Traditionally, surgical risk has been assessed primarily in terms of the extent of patient disease, comorbidities, and the complexity of the procedure, with relatively little attention to the role of health-care providers and the system in which care is delivered. This view has begun to change over the last decade. As understanding of patient safety grows, there is increasing recognition of individual practitioners' impact on surgical outcomes. In particular, safety experts stress that individuals' interactions with each other (as a team) and with their environment (as a system) are critical determinants of error.

Data collected by the Joint Commission on Accreditation of Healthcare Organizations suggest that poor communication contributed to nearly 70% of sentinel events reported during 2005.[1] Studies in the surgical domain illustrate the prevalence of communication breakdown in the perioperative period. For example, in an observational study of 48 surgical cases, Lingard and colleagues[2] identified 421 communication events and classified nearly one-third of them as "failures." Our own observational study of general surgery cases found communication breakdowns or information loss in all 10

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cases that were observed.[3] In addition, we documented a generalized vulnerability of the entire perioperative period to communication breakdowns, with information loss occurring at every point from the patient's first office consultation with the surgeon to care in the recovery room.

These findings suggest that successful reduction of communication breakdowns can substantially improve patient safety and reduce errors. The diversity of communication activities and the number of communicators involved in surgical care make it difficult to know where to target such interventions. Communication occurs within and across locations, including inpatient and outpatient care, and pre-, intra-, and postoperative care; it often involves multiple agents, including attending surgeons, anesthesiologists, housestaff, nurses, and ancillary staff; and covers a mix of vital topics, such as patient status, intraoperative events, or plan of care. Using information gathered during a previous study[4] of medical malpractice claims, we sought to identify recurrent patterns of serious communication breakdowns. The goal was to develop and prioritize initiatives to prevent communication breakdown resulting in injury to surgical patients.

METHODS

Data collection

Data were originally collected as part of a larger study, the Malpractice Insurers' Medical Error Prevention Study (MIMEPS), which analyzed surgical errors in closed claims at four malpractice insurance companies. The participating insurers cover approximately 21,000 physicians at 46 acute care hospitals (20 academic and 26 nonacademic) and 390 outpatient facilities. The MIMEPS data-collection methods are reported in detail elsewhere.[4] We summarize them briefly here.

Closed claims involving surgical care were randomly sampled at each site and submitted for review by senior surgical residents, surgical fellows, and board-certified surgeons, who were trained by the investigators and assisted by a detailed manual. To extract the data, they reviewed both the medical records pertaining to the disputed care and the claim file. Claims files include a wide range of information on the alleged event, including statements presenting the plaintiff's view, depositions, and expert opinions from both sides.

A total of 444 surgical claims were reviewed, of which 258 were found to involve an error that led to patient injury. Claims with both injury and error underwent additional review to investigate contributing factors. Reviewers detected communication breakdowns in nearly one-quarter (60 of 258) of them. These 60 cases are the focus of this analysis (Fig. 1).

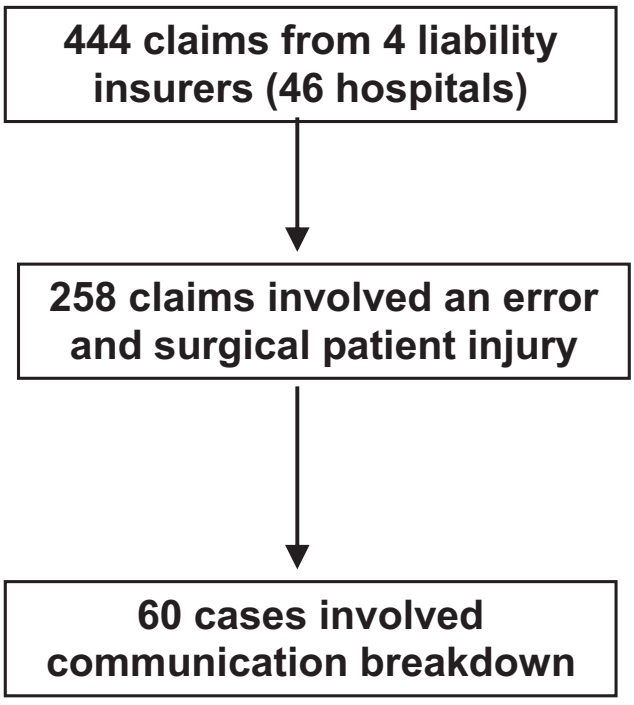

Figure 1. Case selection.

Review of study cases

Two surgeon-investigators (CCG and SER) conducted a secondary review of all information gathered in the original MIMEPS study on the 60 cases involving communication breakdowns. Each investigator independently classified the breakdowns by type and contributing factors. Disagreements were resolved by consensus review or, when consensus could not be reached, by decision of a third investigator (AAG).

To structure the secondary review, we developed an initial set of variables and classification categories. These were based on a review of the literature and findings from previous field studies.[3,5] The list of categories was also examined by an expert in human factors analysis for completeness. Each variable and category was assigned a standard definition before the review began. During the review itself, amendments were made to the classification schema by consensus of the physician-reviewers as an iterative process.

The following standard definitions were applied. Synchronous communication occurs when both parties are involved in a conversation, either face to face or by telephone. An asynchronous communication occurs when communication is not instant (eg, email, written or taped message, charting).[6] Status asymmetry is defined as the situation in which one agent has substantially more power or greater rank than another. A handoff occurs when there is complete transfer of care from one provider to another and the first provider physically leaves the scene. A transfer in care is the physical movement of patients from one location of care to another. Transfers might or might not involve handoffs, and vice versa. An emergent case is defined as one that must start as soon as possible and definitely within 4 hours of booking, although an urgent case must start within 12 hours of booking.

Data analysis

Our analyses are descriptive. We calculated frequencies for the variables and categories of interest. Missing data were not used in calculating frequencies unless they occurred in > 25% of breakdowns and were then included as a separate class. To test interrater reliability, we calculated kappa statistics for each variable based on a comparison of the original pair of independent determinations by the two reviewers. Data were analyzed using SAS version 9.0 (SAS Institute).

Development and evaluation of potential interventions

Through a qualitative assessment of the communication breakdowns, we developed a set of policies with the potential to have high impact in reducing communication breakdowns based on the patterns we observed. The original case descriptions were then re-reviewed to determine which could have been prevented by the suggested policies. Communication breakdowns were classified as preventable if, in the reviewer's judgment, it was highly likely that the breakdown would not have occurred if the policy had been in place; they were classified as potentially preventable if there was evidence to suggest that the policy might have prevented the breakdown or mitigated the impact of the breakdown.

RESULTS

Patient characteristics

General case characteristics are summarized in Table 1. Seventy-two percent of cases involved a single communication breakdown, 23% involved 2 communication breakdowns, and 5% involved 3 or more. The majority of cases were elective or scheduled operations (64%), 13% were urgent, and 14% were emergent. The prevalence of emergent cases is higher than expected. As a comparison, among 767 general and vascular cases identified through the National Surgical Quality Improvement Project database at our institution, 14.9% of the cases were urgent, but only 1.7% were emergency cases.

Table 1. Case Characteristics for 60 Cases Involving Communication Breakdowns

Case characteristics (κ)	n	%
Total no. of breakdowns (0.73)		
1	43	72
2	14	23
3 or more	3	5
Trainee involved (0.96)		
Yes	37	58
No	27	42
Missing	17	—
Type of procedure (0.94)		
No surgical procedure	6	9
Elective or scheduled	45	64
Urgent	9	13
Emergent	10	14
Missing	11	—

Description of the communication breakdowns

The 60 cases contained a total of 81 communication breakdowns (range 1 to 6 per case), which were examined separately to identify common characteristics. The breakdowns were equally likely to occur in the preoperative (38%), intraoperative (30%), and postoperative (32%) phases of care (Table 2). Most communication breakdowns occurred within a single department (78%), but 19% occurred across departments and 2% across institutions.

Ninety-two percent of the breakdowns were verbal and the majority occurred between a single transmitter and a single receiver (64%). Cross-disciplinary and intradisciplinary communication breakdowns occurred with approximately the same frequency. Most commonly, information was never transmitted (49%); or information was communicated but inaccurately received (44%). The information tended to be related to intraoperative events (39%) or patient status (32%). See Table 2 for more detailed results.

Table 2. Description of 81 Communication Breakdowns that Occurred in 60 Cases

Description of event (κ)	n	%
Location (0.89)		
Across institutions	2	3
Across departments	15	19
Within a single department	62	78
Missing	2	—
Point of care (0.92)		
Preoperative inpatient	14	18
Preoperative outpatient	10	12
Intraoperative	24	30
Postoperative	26	32
Inpatient (no operation)	6	8
Outpatient	0	0
Missing	1	—
Form of communication 1 (0.79)		
Verbal	60	85
Written	3	4
Both verbal and written	5	7
Test results	3	4
Missing	10	—
Form of communication 2 (0.84)		
Synchronous	55	86
Asynchronous	9	14
Missing	17	—
How many people involved? (0.66)		
Just one transmitter and one receiver	49	64
Broadcast to multiple people	16	21
Multiple sequential breakdowns	12	16
Missing	4	—
Total number of people involved (0.83)		
1	1	1
2	51	69
3	16	22
4 or more	6	8
Missing	7	—
Nature of communication breakdown (0.73)		
Information transmitted but never received	5	7
Information was never transmitted	35	49
Information was communicated but inaccurately received	31	44
Missing	10	—
Information related to (0.83)		
Preoperative information or past medical history	15	19
Intraoperative events	31	39
Patient status	25	32
Events outside of the operating room	2	2
Future plan of care	6	8
Missing	2	—
Disciplines involved (0.91)		
Not applicable	10	13
Cross-disciplinary	26	34
Intradisciplinary	28	36
Both	13	17
Missing	4	—

Table 3. Most Common Transmitter and Receiver Agents Overall

	Transmitter* (n = 83)		Receiver* (n = 98)	
	n	%	n	%
Surgery attending	24	29	55	56
Surgery resident	14	17	12	12
Anesthesia attending	3	4	7	7
Anesthesia resident	2	2	1	1.0
OR nursing	16	19	12	12
Perioperative nursing	3	4	0	0
Patient or family	6	7	5	5
Other attending	8	10	3	3
Other resident	2	2	3	3
Other staff	5	6	0	0

*Number of transmitters and receivers listed reflects the fact that there can be more than one transmitter and receiver for each communication breakdown. Each agent was treated independently for this analysis.
OR, operating room.

Attending surgeons were the most common transmitters (24 of 83, or 29%) and receivers (55 of 98, or 56%) in communication breakdowns overall (Table 3). Among failures that involved a single transmitter and a single receiver (n = 49), the most frequent dyads were attending-surgeons' communication with another attending surgeon (n = 9), a surgical resident (n = 9), and patients or their family members (n = 9).

Cases related to miscounts

Eleven of 81 communication breakdowns (14%) involved a miscount of instruments or sponges and conformed to the same pattern: a single, intraoperative breakdown that involved a broadcast of information to multiple providers and at least 3 team members (a circulating nurse, a scrub nurse/technician, and the attending or resident surgeon). They occurred within a single department; involved both intra- and cross-disciplinary communication; were verbal, synchronous communications; and related to intraoperative events. Excluding communication breakdowns involving miscounts from the analysis altered the emerging patterns in several ways.

Because miscounts occur exclusively in the operating room, their exclusion increases the proportion of communication breakdowns that occurred in the preoperative (34%) and postoperative periods (37%), relative to intraoperative occurrences (19%). Excluding breakdowns involving counts also increased the proportion of

Table 4. Factors Associated with 81 Communication Breakdowns in 60 Cases

System and human factor (κ)	n	%
Status asymmetry (0.74)		
Yes	57	74
No	20	26
Missing	4	—
Conflicting team goals (0.88)		
Yes	18	17
No	12	20
Missing	51	63
Handoff among providers (0.76)		
Yes	35	43
No	25	31
Missing	21	26
Transfer of patient from one point of care to another (0.73)		
Yes	30	39
No	47	61
Missing	4	—
Ambiguity of roles, responsibility, and leadership (0.59)		
Yes	47	58
No	17	21
Missing	17	21
Communication breakdown involved counting protocol (0.95)		
Yes	11	14
No	70	86
Period of high workload or competing tasks (1.00)		
Yes	17	21
No	6	7
Missing	58	72

1 transmitter to 1 receiver communications to 71% (from 64%); increased the proportion of communication breakdowns in which information was never transmitted to 57% (from 49%), at the same time decreasing those in which information was inaccurately received to 35% (from 44%). Communications about patient status became the most frequent topic of communication breakdowns (37%), while intraoperative events dropped to 29% (from 39%).

Factors associated with communication breakdowns leading to patient injury

Status asymmetry between agents was the most prevalent of the factors we investigated, reflecting the frequent involvement of the attending surgeon in these communication breakdowns (Table 4). Ambiguity about roles, responsibilities, and leadership was also common, occurring in at least 58% of cases. At least 43% of communication breakdowns occurred in connection with a handoff among providers; 39% of the cases involved a transfer of the patient from 1 point of care to another.

Factors associated with communication breakdowns demonstrated clear patterns based on the agents involved. All but one of the nine attending-to-attending breakdowns involved the handoff of care from one attending to the next; and in the final case, there was not enough information to determine if a handoff was involved. Ambiguity about responsibility was also evident in most (seven of nine) of these cases. All nine of the resident-to-attending communication breakdowns related to information not being transmitted from the resident to the attending. In each case, status asymmetry was present (by definition) and there was ambiguity about roles and responsibilities. In seven of nine, the information related to the postoperative status of a patient.

Cases related to miscounts

The relative frequency of the associated factors noted here was also altered by the exclusion of breakdowns relating to counts. The proportion of communication breakdowns involving ambiguity about roles and responsibilities increased (from 58% to 82% of events for which information was available), as did patient transfers (from 39% to 45%), but proportion associated with handoffs decreased (43% to 37%). Counting errors accounted for 10 the 16 instances where an operating-room nurse acted as the transmitter, and 10 of the 12 instances where the nurse was the receiver. Removing these cases did not substantially alter the relative frequency of the other agents in acting as transmitter or receiver.

Interrater reliability

The original MIMEPS analysis demonstrated very good interreviewer reliability for the error judgment (91% agreement; $\kappa = 0$ .80; 95% CI, 0.24−0.92).[7] Agreement among the surgeon-reviewers in our secondary analysis was good to very good for case characteristics ($\kappa = 0.73-0.94$) and the description of the communication breakdown ($\kappa = 0.66-0.92$). The majority of system and human factors were also evaluated with good to very good agreement ($\kappa = 0.74-1.00$), except for ambiguity about roles and responsibilities, which was moderate ($\kappa = 0.59$). Kappa coefficients for each characteristic or factor are displayed in Tables 1, 2, and 4.

Table 5. Proposed Triggers Prompting Communication with the Surgical Attending Currently Responsible for the Patient

Potential triggers
Change in location of patient
Admission or discharge from the hospital
Transfer into or out of the ICU
Patient visit to the emergency department
Serious event
Unplanned intubation or ventilatory support
Cardiac arrest, new arrhythmia, or hemodynamic instability
Development of substantial neurological changes
Development of major wound complications
Unplanned blood transfusion
Medication or treatment errors requiring clinical intervention
Invasive procedure or operation (by any service)
Staff concern
Concern by a trainee that a situation is more complicated than he can manage
Request by nursing or another physician or family member that attending surgeon be contacted

Development and evaluation of potential interventions

Through qualitative review of the patterns of error causality identified, we developed and tested a set of promising interventions for reducing communication failures in the care of surgical patients. First, a defined set of "trigger" events was developed (Table 5). When any of these events occurred, a nurse or member of the housestaff involved in the care would be required to communicate with an attending. The nature of these triggers makes them applicable to preoperative and postoperative settings, not intraoperative care.

Several other potential interventions are suggested by the fact that most failures were verbal, synchronous, and involved two single agents. Combined with the frequent misinterpretation of transmitted information, these characteristics suggest that the standard use of read-backs could improve communication. Finally, the temporal correlation with handoffs and transfers in care point to the potential value of structured protocols for these tasks, particularly for handoffs between attending surgeons.

Review of the 34 cases that occurred outside of the operating room suggested that the triggers listed in Table 5 might have prevented at least 26%, and up to 44%, of these incidents of communication breakdowns, and standardized handoffs and transfer protocols might have prevented between 11% and 35% of them. The 2 interventions together would potentially have prevented at least 29%, and as many as 47%, of the communication breakdowns. If confined to inpatients, the combination of these interventions has the potential to prevent at least 45% and up to 73%, with triggers alone preventing 41% to 68% and handoff and transfer protocols alone preventing 18% to 54%. There were insufficient data about the actual transmission of information to determine the impact of instituting read-backs.

DISCUSSION

Malpractice claims files provide a useful source of data for studying patient safety in the health-care system.[8-10] These data offer an excellent adjunct to observational field studies and other safety investigations. In our analysis of surgical malpractice claims, we identified recurring patterns of and contributors to communication breakdown that resulted in injury to surgical patients. These findings also guided us toward several interventions with the potential to effect major improvements in perioperative safety.

We found that serious communication breakdowns leading to a malpractice claim tend to occur in verbal communications between a single transmitter and a single receiver. They occur at least as often during the pre- and postoperative care as during the intraoperative course, and emergency operations are at increased risk for information loss. This finding distinguishes communication errors from surgical errors more generally, which occur predominantly in the intraoperative period. In MIMEPS, 75% of cases involved an intraoperative error, but only 25% of cases involved an error in the preoperative period, and 35% in the postoperative period.[4] The attending surgeon is the agent most frequently involved in these serious communication breakdowns. Finally, there is evidence that handoffs and transfers in care are especially vulnerable to communication breakdown. These results suggest we prioritize the development of triggers that mandate communication with surgical attendings, standardized handoffs and transfer protocols, and read-backs.

Another approach to improving communication in medicine adapts strategies from other high-risk domains, such as nuclear reactor control rooms. Through review of data from observational field studies of handoffs in other high-risk domains, investigators have identified strategies that could potentially be adapted to health care and found results similar to ours.[11] Several of the target areas that we identified were among the 21

strategies suggested in this "translocational" study, including the standardization of content and format, read-backs to ensure the information was correctly received, and the unambiguous transfer of responsibility.

The 2006 Joint Commission on Accreditation of Healthcare Organizations National Patient Safety Goals included a requirement that institutions implement a standardized approach to handoffs.[12] Most institutions are still struggling with prioritizing and instituting policies and guidelines to meet this requirement. Researchers have also begun to investigate methods for standardizing the content and format of communication activities and handoffs. For example, the University of Washington has developed and validated a computerized resident sign-out system that facilitates the transfer of care from one resident to another.[13] In a randomized, controlled trial, investigators were able to demonstrate improved quality and continuity of care and efficiency according to frontline users of the system.[14]

We were unable to identify any literature describing the use of a list of "triggers" mandating communication with attending surgeons; this is common practice to varying degrees. For example, it is common to include in postoperative orders, aberrant vital signs and other parameters for which a physician should be notified. Part of surgical training includes gaining the experience to recognize critically ill patients and the knowledge to involve more senior staff or specialist colleagues in care that is beyond one's skill set. Our results suggest that a formalized policy that sets specific triggers for communication with an attending surgeon could lead to improvements in safety. Formal studies of their ultimate impact on safety are required, but the preliminary results of this study of malpractice claims suggest such triggers have the potential to mitigate a majority of serious injuries to surgical patients.

In addition to the standardized read-backs, as suggested in this study, surgical safety researchers have evaluated several other measures for improving communications in the operating room. For example, others have adapted techniques from the aviation domain, including crew resource management and standardized team briefings.[15-24] Additional investigation of these interventions is needed to determine their efficacy. Recognizing that 11 of 24 intraoperative communication breakdowns related to the counting protocol, other investigations by our group are working to characterize vulnerabilities in the current counting practices and develop technological solutions to improve their performance.

The major limitation of this study relates to the use of malpractice claims as a proxy for safety in health care. It is possible that there are systematic differences in the patterns of communication breakdowns that we identified within these malpractice claims and communication breakdowns in operations overall. For example, it is possible that communications with the attending surgeon were overrepresented in this sample, as the attending surgeon is the member of the team most likely to be named in a lawsuit. In addition, there are many other potential contributing factors that cannot be evaluated using claims data. Some have argued that malpractice claims might not represent important failures in care, in fact, the vast majority of cases involve actual injury (97%) to a patient and medical error (63%).[25] In this study, we evaluated only cases in which an identifiable error resulted in injury. Cases without error, injury, or both, were excluded during the first evaluation by the MIMEPS study design.

Communication breakdowns are among the most frequent contributors to adverse events in medicine, including serious injury to surgical patients. As a discipline, we are just beginning to understand the importance of communication in surgical safety. Until more information is available, the results of this study suggest that more frequent and standardized communication with attending surgeons, standardization of handoff and transfer protocols, and the use of read-backs in individual communications are the prevention strategies with the greatest potential to improve safety.

Author Contributions

Study conception and design: Greenberg, Regenbogen, Studdert, Gawande
Acquisition of data: Greenberg, Regenbogen, Studdert, Rogers, Gawande
Analysis and interpretation of data: Greenberg, Regenbogen, Lipsitz, Zinner, Gawande
Drafting of manuscript: Greenberg
Critical revision: Greenberg, Regenbogen, Studdert, Lipsitz, Rogers, Zinner, Gawande

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