

# INCIDENCE OF WRONG-SITE SURGERY AMONG HAND SURGEONS

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**Background:** Until recently, wrong-site surgery had received little attention and had been considered a random, infrequent event. In 1997, the American Academy of Orthopaedic Surgeons (AAOS) Task Force on Wrong-Site Surgery was formed to determine the incidence of wrong-site surgery and to initiate the "Sign Your Site" campaign. The purpose of our study was to determine the incidence of wrong-site surgery among hand surgeons, elucidate surgeons' practice habits and measures taken to prevent its occurrence, and evaluate the effectiveness of the AAOS "Sign Your Site" campaign.

**Methods:** One thousand, five hundred and sixty active members of the American Society for Surgery of the Hand (ASSH) were polled by mail. Each member received a confidential twenty-nine-question survey. Nonrespondents were sent a second, identical survey. One thousand and fifty (67%) of the surgeons responded.

**Results:** One hundred and seventy-three surgeons (16%) reported that they had prepared to operate on the wrong site but then noticed the error prior to the incision, and 217 (21%) reported performing wrong-site surgery at least once. Of an estimated 6,700,000 surgical procedures, 242 were performed at the wrong site, an incidence of one in 27,686 procedures. The three most common locations of wrong-site surgery were the fingers (153), hands (twenty), and wrists (twenty-one). Permanent disability occurred in twenty-one patients (9%). Ninety-three cases (38%) led to legal action or monetary settlement. Seventy percent of the responding orthopaedic surgeons were aware of the "Sign Your Site" campaign, and 45% had changed their practice habits as a result.

**Conclusions:** Prior to the AAOS "Sign Your Site" campaign, the issue of wrong-site surgery by hand surgeons had not been addressed. Although wrong-site surgery is rare, 21% of hand surgeons reported performing it at least once during their careers. Since the institution of the "Sign Your Site" campaign, 45% of orthopaedic hand surgeons have changed their practice habits, and almost all routinely take some action to prevent wrong-site surgery.

Medical errors have a tremendous social and financial impact on American society. An estimated 98,000 patients die annually because of medical mishaps, and the annual costs approach \$9 billion in the United States alone<sup>1</sup>. This toll exceeds the total number of deaths from motor-vehicle and airplane crashes, suicides, falls, poisonings, and drownings<sup>2</sup>. Legal claims against orthopaedic surgeons represent 9% to 11% of all medical malpractice claims, and approximately 30% of all orthopaedic claims result in a legal settlement<sup>3</sup>. Wrong-site surgery accounts for only 2% of all orthopaedic surgery claims, but 84% of those claims result in a court award to the plaintiff<sup>3,4</sup>.

In a review of claims against an orthopaedic training program, Watson et al. found that operations at the wrong anatomic site, improper use of equipment, and missed or delayed diagnosis were associated with a favorable outcome for the plaintiff<sup>5</sup>. Johnson reported one incident of wrong-site surgery in almost 16,000 cases at the Orthopaedic Institute in

Fargo, North Dakota<sup>6</sup>. Furthermore, a recent American Academy of Orthopaedic Surgeons (AAOS) Bulletin report stated: "A successful legal defense to surgery performed on the incorrect limb is almost impossible."<sup>7</sup>

In response to the gravity of this problem, in 1994 the Canadian Orthopaedic Association developed a successful educational program to reduce the incidence of wrong-site surgery<sup>8</sup>. In 1997, the Council on Education of the American Academy of Orthopaedic Surgeons formed the Task Force on Wrong-Site Surgery. Its goals were to determine the incidence of wrong-site surgery and to recommend methods to prevent its occurrence. The Task Force reviewed data obtained from the insurance records of twenty-two malpractice insurance carriers covering 110,000 physicians of all specialties<sup>4</sup>, and the data were summarized by Cowell<sup>9</sup>. Three hundred and thirty-one wrong-site-surgery claims were identified; 225 were related to orthopaedic procedures. Only 1.8% of the claims were attributed to wrong-site surgery, but 84% of the claims due to wrong-site surgery resulted in payment to the plaintiff compared with 30% of all orthopaedic claims. In addition, the Task Force reviewed thirty-seven claims submitted to one insurance carrier over a twenty-year period that resulted in a pa-



**TABLE I** Number of Surgeons Reporting a Wrong-Site Error After Incision\*

Specialty	Type of Practice			Total
	Academic	Combined	Private	
General surgery	0 (0%)	5 (38%)	7 (23%)	12 (26%)
Orthopaedic surgery	29 (23%)	41 (19%)	103 (21%)	173 (21%)
Plastic surgery	11 (19%)	9 (13%)	12 (15%)	32 (17%)
Total	40 (22%)	55 (19%)	122 (21%)	217 (21%)

\*The percentage of all surgeons in category is given in parentheses.

tient award. Thirty-six occurred in a hospital and one, in an outpatient surgery center. The error was the fault of the surgeon alone in seventeen (46%) of the thirty-seven cases, and the operating room staff incorrectly draped or scrubbed the wrong site in fifteen cases (41%). Seventy percent of the patients had no residual disability other than a scar. In another analysis, in which it was assumed that 251 orthopaedic surgeons each had a thirty-five-year average career length, the AAOS task force estimated that each surgeon had a one in four chance of performing wrong-site surgery at least once.

To our knowledge, there have been no studies specifically addressing the topic of wrong-site surgery in the peer-reviewed literature. As a result, we are uncertain of the magnitude of the problem. The purpose of this survey was to determine the incidence of wrong-site surgery among hand surgeons, to elucidate surgeons' practice habits and measures taken to prevent its occurrence, and to evaluate the effectiveness of the AAOS "Sign Your Site" campaign.

### Materials and Methods

Our study group consisted of all 1560 active members of the American Society for Surgery of the Hand (ASSH) as of February 2000. Between February and April 2000, each member was mailed a twenty-nine-question survey regarding wrong-site surgery. A second, identical survey was sent to surgeons who did not initially respond. A numeric coding system ensured that all responses were confidential. The survey consisted of three sections. The first section asked for information about the surgeon's specialty,

practice type, and operative load. The second section asked for details about any episodes of wrong-site surgery. The third section assessed the influence of the "Sign Your Site" campaign and safeguards taken to prevent wrong-site surgery. A crude estimate of the total number of surgical procedures was derived by multiplying each surgeon's yearly caseload by the number of years in practice. All information was collected and entered into a database (Microsoft Excel, Seattle, Washington). Chi-square statistical analysis was performed on all collected data. Findings were considered significant when the p value was <0.05.

To determine the validity of the survey, a second, identical questionnaire was sent to all forty-five hand surgeons residing in Ohio approximately two years following the original questionnaire. Agreement between the two surveys was excellent for every response, with kappa values ranging from 0.5 to 1 for all responses. The only inconsistent responses were those to the two questions regarding detection of the wrong-site error either before or during the procedure. Agreement between reported details, such as the site

of the procedures, type of anesthesia, recognition of the error, and subsequent legal action, was excellent.

### Results

One thousand and fifty (67%) of the polled hand surgeons responded to the survey. Forty-six (4%) were general surgeons, 188 (18%) were plastic surgeons, and 816 (78%) were orthopaedic surgeons. One hundred and eighty (17%) were in academic practice, 291 (28%) were in combined academic and private practice, and 579 (55%) were in private practice.

One hundred and seventy-three surgeons (16%) reported that they had prepared to operate on the wrong site but had noticed the error prior to the incision. Six general surgeons (13%), 132 orthopaedists (16%), and thirty-five plastic surgeons (19%) reported this error. No significant difference was noted among the specialties. Twenty-one percent of the surgeons in academic practice, 12% of those in combined practice, and 17% of those in private practice noticed their error prior to incision. Physicians in combined practice had a lower risk of preparing to operate on an improper site than did surgeons in academic or private practice ( $p = 0.015$ ).

Two hundred and seventeen surgeons (21%) reported performing wrong-site surgery at least once during their professional career. One hundred and ninety-three (18%) reported one incident, twenty-three (2%) reported two incidents, and one (0.1%) reported three incidents of wrong-site surgery. With the numbers available, the incidence of wrong-site surgery was not found to differ significantly among the different spe-

**TABLE II** Number of Wrong-Site Errors Reported\*

Specialty	Type of Practice			Total
	Academic	Combined	Private	
General surgery	0 (0%)	5 (2%)	8 (3%)	13 (5%)
Orthopaedic surgery	32 (13%)	47 (19%)	118 (49%)	197 (81%)
Plastic surgery	11 (5%)	10 (4%)	11 (5%)	32 (13%)
Total	43 (18%)	62 (26%)	137 (57%)	242

\*The percentage of total errors is given in parentheses.

TABLE III Location of Wrong-Site Errors\*

Finger	153 (63%)
Hand	20 (8%)
Wrist	21 (9%)
Elbow	5 (2%)
Spine	1 (0.5%)
Pelvis	1 (0.5%)
Hip	15 (6%)
Thigh	1 (0.5%)
Knee	12 (5%)
Ankle	2 (1%)
Foot	8 (3%)
Other (not specified)	3 (1%)
Total	242

\*The percentage of total errors is given in parentheses.

cialties or practice types (Table I). Of an estimated 6,700,000 procedures performed by the surgeons, 242 were performed at the wrong site, an incidence of one in 27,686 procedures (Table II). Of the 242 wrong-site surgical procedures, 153 (63%) were performed on a finger; twenty-one (9%), on the wrist; and twenty (8%), on the hand. Other locations and their frequencies are listed in Table III.

Twenty-one (9%) of the 242 procedures resulted in permanent disability to the patient, and ninety-three (38%) led to legal action against the physician or a monetary settlement. Sixteen (76%) of the twenty-one procedures resulting in disability and seventy-seven (35%) of the 221 not resulting in disability led to legal action ( $p < 0.0001$ ).

The rates of wrong-site surgery tended to increase with increasing surgeon age and years in practice, but these trends were not significant. There was, however, a significant correlation between the rate of wrong-site surgery and yearly case-load ( $p = 0.02$ ) (Table IV).

Nine hundred and ninety-five (95%) of the surgeons responded to the question regarding whether they were aware of the "Sign Your Site" campaign (Table V). Of 773 orthopaedic surgeons who responded to this question, 540 (70%) knew of the program, whereas only sixteen (36%) of forty-four general surgeons and forty-five (25%) of 178 plastic surgeons who responded knew of the program. Of the 601 surgeons who were aware of the campaign, 265 (44%) had changed their practice habits as a result. Two hundred and forty (45%) of all responding orthopaedic hand surgeons were aware of the "Sign Your Site" campaign and had changed their practice habits as a result (Table VI).

All physicians were asked how frequently they performed certain activities that could identify the proper surgical site and prevent a wrong-site incident prior to surgery.

Eighty-five percent (832 of 984 who responded to the question) always had their operating room staff review the surgical consent form, 65% (645 of 987) always reviewed office notes prior to the procedure, 62% (621 of 999) always spoke with the patient, 59% (389 of 661) always reviewed the office consent form, 56% (560 of 995) always reviewed radiographs, and 52% (512 of 984) always reviewed the surgical consent form. Forty-eight percent of the respondents noted that the correct operative site was always marked by the surgeon, a member of the operating room staff, or the patient. Twenty-five percent reported that the patients always marked the surgical site themselves. All respondents reported carrying out at least one of these measures regularly.

### Discussion

Wrong-site surgery is a preventable and largely indefensible surgical complication. Although isolated incidents of this mistake have occurred with virtually all surgical procedures and there have been numerous editorials warning of its dangers, we are not aware of any studies of large series to date.

Recently, this topic received much attention from the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and in the popular press. In December 2001, a Sentinel Event Alert issued by JCAHO reported 150 cases of wrong-site, wrong-person, or wrong-procedure surgery<sup>10</sup>. Forty-one percent of these procedures were related to orthopaedic or podiatric surgery. Risk factors included an emergency case, unusual physical characteristics of the patient, time pressures, multiple surgeons, and multiple procedures performed on the same patient. This report, along with interviews and commentary, was summarized in *The New York Times*<sup>11</sup>.

We surveyed all members of the American Society for Surgery of the Hand to estimate the incidence of wrong-site surgery and to determine which safeguards are commonly used to prevent its occurrence. The rate of wrong-site surgery by hand surgeons may or may not mirror that of other subspecialty groups. The risk of performing wrong-site surgery may be higher for hand surgeons than it is for surgeons whose practices focus on paired structures. It is interesting to note that the preponderance of wrong-site procedures performed by hand surgeons were done on fingers, rather than on paired structures such as the hands, wrists, or elbows. Eighty percent

TABLE IV Surgical Volume and Wrong-Site Errors

Procedures per Year	Rate of Wrong-Site Surgery
0-100	0
101-200	17%
201-300	17%
301-400	19%
401-500	25%
>500	23%

**TABLE V** Number of Surgeons Aware of “Sign Your Site” Campaign\*

Specialty	Surgeon Aware		Total
	No	Yes	
General surgery	28 (64%)	16 (36%)	44 (4%)
Orthopaedic surgery	233 (30%)	540 (70%)	773 (78%)
Plastic surgery	133 (75%)	45 (25%)	178 (18%)
Total	394 (40%)	601 (60%)	995

\*The percentage of the surgeons within the specialty (who responded to the question) is given in parentheses.

of the wrong sites reported in this survey were fingers, hands, or wrists, which mirrors the types of procedures that a typical hand surgeon is likely to perform. While not specifically addressed by our survey, it would seem logical that hand surgeons are much more likely to operate on the upper extremity rather than on other structures such as the hips, knees, or ankles. Therefore, the preponderance of errors performed on the upper extremity may not reflect the sites at risk for errors by general orthopaedists. The incidence at other anatomic sites can be accurately determined only by studying other subsets of orthopaedic surgeons. The percentage of traumatic compared with atraumatic etiologies resulting in wrong-site surgery was not assessed; it is plausible that obvious traumatic injuries are less likely to result in wrong-site surgery.

The AAOS Task Force drew its data from insurance records. Thirty-seven claims resulting in a patient award were reviewed. The most common sites reported in those claims were the knee, foot and ankle, and hip. Arthroscopy was the most common erroneously performed procedure, followed by reconstructive joint procedures and fracture surgery. Because the AAOS report relied solely on data obtained from insurance company records, only cases involving litigation were reviewed. Cases that did not result in disability or litigation were not discovered, leading to an underestimation of the true incidence of wrong-site surgery. Our study captures the important subset of patients who did not initiate legal action. Thirty-eight percent (ninety-three) of the 242 wrong-site procedures identified in our study resulted in monetary settlement or legal action. A strong association between disability and litigation was also noted. Seventy-six percent (sixteen) of the twenty-one patients who were disabled, compared with 35% (seventy-seven) of the 221 who were not, pursued legal action. Any study that relies on legal records or insurance claims would fail to capture the full spectrum of patients.

While the goal of our study was to capture all patients affected by wrong-site surgery, the data may still underestimate the true incidence of this problem. Our retrospective survey relied solely upon information reported to us by individual surgeons, and the data may have been influenced by poor recall and unwillingness to report events. Despite different methodologies for data collection, our rate appears higher than that re-

ported by the AAOS task force<sup>4</sup> (331 incidents among 110,000 surgeons, or 0.3%) but lower than that reported by Johnson (one in 15,987 cases), in a much smaller sample<sup>6</sup>.

We estimated the incidence of wrong-site surgery to be one occurrence in 27,686 procedures, with approximately 20% of surgeons having performed wrong-site surgery. This value is based on a gross estimate of each surgeon's productivity. We recognize that this is a crude estimate of the exact incidence of wrong-site surgery, but it reflects the magnitude of a problem that should be completely preventable. An exact calculation of the total number of procedures that each surgeon performed during his or her career is beyond the scope of our study and would be impractical, if not impossible, to determine.

Although one might expect young and inexperienced surgeons to be more likely to perform wrong-site surgery, our data did not support this assumption. Rather, the risk of performing wrong-site surgery tends to increase with physician age and time in practice, and it is directly associated with case-load. Significant differences were not noted among practice types or surgical specialties, suggesting that experience, the presence of surgical residents, or the intricacies of surgical training do not influence the risk. The implication of these findings is that every surgeon is at risk for performing wrong-site surgery during his or her career, all must be aware of its potential occurrence, and all must take action to prevent it from happening.

The “Sign Your Site” campaign targeted and reached a significantly higher percentage of orthopaedic surgeons than general or plastic surgeons. Seventy percent of orthopaedic surgeons were aware of the campaign, and 45% of them had changed their practice habits as a result. Among orthopaedic hand surgeons, those who had performed wrong-site surgery were more likely than those who had not made such an error to have recalled the “Sign Your Site” campaign (24% compared with 9%) and to have changed their practice habits (35% compared with 22%). Determination of whether the surgeon changed his or her practice habits before or after the campaign was beyond the scope of our study.

The AAOS “Sign Your Site” campaign has had an impact. Fully 70% of the orthopaedic surgeons, as opposed to

**TABLE VI** Number of Surgeons Who Changed Practice Habits as a Result of “Sign Your Site” Campaign\*

	Surgeon Changed Practice Habits		Total
	Yes	No	
General surgery	7 (47%)	8 (53%)	15 (2%)
Orthopaedic surgery	240 (45%)	298 (55%)	538 (89%)
Plastic surgery	18 (34%)	35 (66%)	53 (9%)
Total	265 (44%)	341 (56%)	606

\*The percentage of the surgeons within the specialty (who were aware of “Sign Your Site” campaign) is given in parentheses.

25% and 36% of the plastic and general surgeons, were aware of the campaign, suggesting that the AAOS was effective in reaching orthopaedic surgeons. Forty-four percent of all surgeons and 45% of orthopaedic surgeons who were exposed to the campaign had changed their practice habits as a result. We believe that the "Sign Your Site" campaign was an effective method for changing surgeons' behavior.

While all surgeons routinely do something to ensure that they are operating in the proper location, much work remains to make certain that the proper surgical site is systematically verified. Only 25% of our respondents reported that they had the patient mark the proper surgical site, which they did because of either hospital policy or personal preference. Furey et al. recently addressed the issue of marking the surgical site<sup>12</sup>. In their survey of 167 Canadian orthopaedic surgeons, only 40% reported that their hospital had a policy of marking the incision site. Seventy-five percent of that group reported marking the surgical site at least occasionally, and younger surgeons and those in academic practice were more likely to mark the surgical site. While many surgeons voluntarily mark the operative site, much more must be done to ensure that this practice becomes a standing policy in North American hospitals.

Wrong-site surgery is a costly, potentially dangerous, but avoidable complication of hand surgery. We found that

the incidence of wrong-site surgery among hand surgeons is much higher than previously estimated. Approximately one in five hand surgeons will perform wrong-site surgery during his or her career. Presently, the AAOS and JCAHO recommend marking of the surgical site in a way that is readily apparent to the surgeon, operating room staff, and patient. On the basis of the results of our survey, we endorse recommendations of marking the surgical site; orally verifying the intended site and procedure; and, in the operating suite, routinely verifying that it is the correct patient, procedure, and site<sup>10</sup>. ■

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The authors did not receive grants or outside funding in support of their research or preparation of this manuscript. They did not receive payments or other benefits or a commitment or agreement to provide such benefits from a commercial entity. No commercial entity paid or directed, or agreed to pay or direct, any benefits to any research fund, foundation, educational institution, or other charitable or nonprofit organization with which the authors are affiliated or associated.

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