

# Adequate Reporting Among Ventral Hernia Repair Operative Reports

## A Cross-Sectional Study of Prevalence of Details and Association With Clinical Outcomes

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**Objective:** We aimed to evaluate the prevalence of highly detailed ventral hernia repair (VHR) operative reports and associations between operative report detail and postoperative outcomes in a medico-legal dataset.

**Background:** VHR are one of the most common surgical procedures performed in the United States. Previous work has shown that VHR operative reports are poorly detailed, however, the relationship between operative report detail and patient outcomes is unknown.

**Methods:** This is a retrospective cross-sectional observational study. Operative reports describing VHR were obtained from a medical-legal database. Medical records were screened and data was extracted including clinical outcomes, such as surgical site infection (SSI), hernia recurrence, and reoperation and the presence of key details in each report. Highly detailed operative reports were defined as having 70% of recommended details. The primary outcome was the prevalence of highly detailed VHR operative reports.

**Results:** A total of 1011 VHR operative reports dictated by 693 surgeons across 517 facilities in 50 states were included. Median duration of follow-up was 4.6 years after initial surgery. Only 35.7% of operative reports were highly detailed. More recent operative reports, cases with resident involvement, and contaminated procedures were more likely to be highly detailed (all  $P < 0.05$ ). Compared to poorly detailed operative reports, cases with highly detailed reports had fewer SSIs (13.2% vs 7.5%,  $P = 0.006$ ), hernia recurrence (65.8% vs 55.4%,  $P = 0.002$ ), and reoperation (78.9% vs 62.6%,  $P = 0.001$ ).

**Conclusions:** In this medico-legal dataset, most VHR operative reports are poorly detailed while highly detailed operative reports were associated with lower rates of complications. Future studies should examine a nationally representative dataset to validate our findings.

**Keywords:** clinical outcomes, operative reports, ventral hernia repair

## INTRODUCTION

Ventral hernia repairs (VHR) are one of the most common surgical procedures in the United States. It is estimated that there are over 600,000 cases each year, which leads to an annual financial burden of \$15 billion.<sup>1-3</sup> These procedures also have a high rate of complications including surgical site infections (SSI), hernia recurrence, and reoperation, which contribute to increased healthcare costs.

The Health Information Technology for Economic and Clinical Health Act, enacted in 2009, was the first piece of legislation to incentivize the implementation of an electronic medical record (EMR) and by 2010 nearly half of all medical

offices nationwide were using some form of an EMR.<sup>4</sup> EMRs were then federally mandated by the American Recovery and Reinvestment Act in 2014.<sup>5</sup>

Operative reports are the definitive method of obtaining information regarding the details of surgery and are critical in postoperative care, and implementation of an EMR has allowed for easier completion of and access to these documents. Accurate and detailed operative reports allow for appropriate postoperative care and assist in guiding overall continuity of care that is tailored to each patient. Additionally, the operative report is essential for physician accountability and billing, research, auditing, and serves as a legal document.<sup>6,7</sup>

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The importance of well-written operative reports has led to the development and subsequent implementation of guidelines for operative reports. However, these guidelines are often vague and provide only the bare minimum in structure.<sup>8,9</sup> For example, those from the Royal College of Surgeons of England give general guidance on what should be included in an operative report, such as operative findings, operative procedure, details of closure technique, and any complications during the procedure.<sup>10</sup> However, few guidelines exist on what exact details should be included in each of these sections for different procedures. The implementation of an EMR has improved documentation with the ability to create templates and certain surgical specialties, such as surgical oncology, have implemented synoptic operative reports which are structured to record key data elements in a standardized format.<sup>11</sup> Synoptic reports have been shown to be superior to narrative reports in terms of documenting quality measures and increasing operative note completeness.<sup>11–13</sup>

Although standards exist in other specialties, there is not a widely used standardized operative note for VHR. Recently, a Delphi consensus was published that lists 16 procedure-specific details that should be included in every VHR operative note.<sup>14</sup> Previous work has shown that many hernia operative reports are poorly detailed, however, the relationship between the quality of an operative note and the patient outcomes is unknown.<sup>13</sup>

This study aims to evaluate the prevalence of highly detailed VHR operative reports, identify factors that are associated with operative report detail, and assess if there is an association between operative report detail and postoperative outcomes in a medico-legal dataset. We hypothesize that among operative reports describing VHR, less than 50% would be highly detailed (defined as  $\geq 70\%$  of recommended details) and that highly detailed reports are associated with improved clinical outcomes.

## METHODS

This was a retrospective cross-sectional observational study of operative reports describing VHR. Institutional review board approval was obtained before the start of the study and Strengthening the Reporting of Observational Studies in Epidemiology guidelines were followed.<sup>15</sup> Operative reports describing VHR were obtained from a previously collected medical-legal database. Reports that described VHR from the United States and had complete author demographic data were included. Those that described other types of hernia repair or had missing data were excluded. We recognized that the sample was an inherently biased group of operative notes (selection bias), however, there are not many ways to provide operative notes from a national perspective. Utilizing a medical-legal database may be one of the very few ways to approach this question of the relationship between operative note detail and patient outcomes.

Medical records were screened by three trained medical specialists and 10% of all charts were audited for quality control in a real-time manner. Data extracted from each medical record included patient details such as demographics, medical history, surgical history, operative and hernia details, and clinical outcomes. All extracted data utilized definitions established by the National Surgical Quality Improvement Project, the Center for Disease Control, the American Hospital Association, or hernia societies.<sup>16</sup>

Details deemed important for inclusion in a VHR operative note have been previously established, and these were used to determine whether a report contained a high level of detail (Supplemental Table 1, see <http://links.lww.com/AOSO/A330>).<sup>14</sup> Highly detailed operative reports were defined a priori as reports that included at least 70% of the recommended details. For operative reports where details were not relevant for the approach, the denominator was adjusted to exclude irrelevant

details. For example, details related to mesh were excluded from scoring when evaluating a report describing suture repair. The list of details scored for each subgroup can be found in Supplemental Text 2, see <http://links.lww.com/AOSO/A331>.

The primary outcome was the percentage of highly detailed VHR operative reports. Assuming the true proportion of highly detailed operative reports was 50% (maximize the sample size), with a 95% confidence level, it was estimated that at least 335 operative reports would be needed. To allow for 2 subgroup analyses, (pre/post year of surgery and teaching/nonteaching hospital) we needed to review at least 1000 operative reports. Highly detailed operative reports were compared to poorly detailed operative reports. For categorical variables, comparisons were made utilizing  $\chi^2$  or Fisher exact test; for continuous variables, either 2-tailed *t* test or Mann–Whitney *U* test was performed. Multivariable regression was performed to assess preoperative and intraoperative details associated with detail of operative reports. Additionally, each clinical outcome was included in these models to assess if operative detail was associated with clinical outcomes. All data analysis was performed using Stata Statistical Software: Release 17. College Station, TX: StataCorp LLC.

## RESULTS

A total of 1011 VHR operative reports were included. The reports were dictated by 693 surgeons for 438 patients across 517 facilities and 50 states. These surgeries were performed from 1995 to 2021. Patients had a mean follow-up of 4.6 (5.7) years after their initial surgery. The mean patient age at time of first repair was 49.4 years old and each patient had a mean of 2.3 VHR.

In total, only 35.7% ( $n = 364/1011$ ) of operative reports were considered highly detailed. On univariate analysis week-end dictations, teaching hospitals, cases with a resident present, complicated cases (contaminated cases, cases with concomitant procedures), and cases in which a mesh repair was performed were more likely to be highly detailed (Table 1). Additionally, operative report quality has increased over time, with an  $R^2$  value of 0.73 (Fig. 1).

Postoperative outcomes were significantly associated with operative report detail. Poorly detailed operative reports were more likely to be associated with SSI, recurrence, reoperation, and readmission (all  $P < 0.05$ ) (Table 2).

On logistic regression, resident involvement in the case, concomitant procedures, contaminated wound class, and use of mesh were associated with highly detailed operative reports. Utilizing stepwise regression, the reduced model demonstrates residents involved in the case, teaching hospitals, contaminated cases, concomitant procedures, and use of mesh were all associated with highly detailed operative reports (Table 3).

Utilizing the full model, each different outcome was added. On logistic regression, patients who had highly detailed operative reports were less likely to develop SSIs or undergo reoperations and readmissions. However, hernia recurrences and mortality had no association with operative detail (Table 4).

## DISCUSSION

In this multi-institutional study of over 1000 VHR operative reports from a medico-legal dataset, there was a substantial deficiency in the level of detail within them. The vast majority of operative reports failed to report at least 70% of recommended information. Perhaps the most significant finding: patients with poorly detailed operative reports had worse clinical outcomes including significantly more SSIs, hospital readmissions, and reoperations.

These results of a generally low percentage of highly detailed narrative operative reports are consistent with prior

**TABLE 1.**  
**Factors That Affect Operative Report Detail**

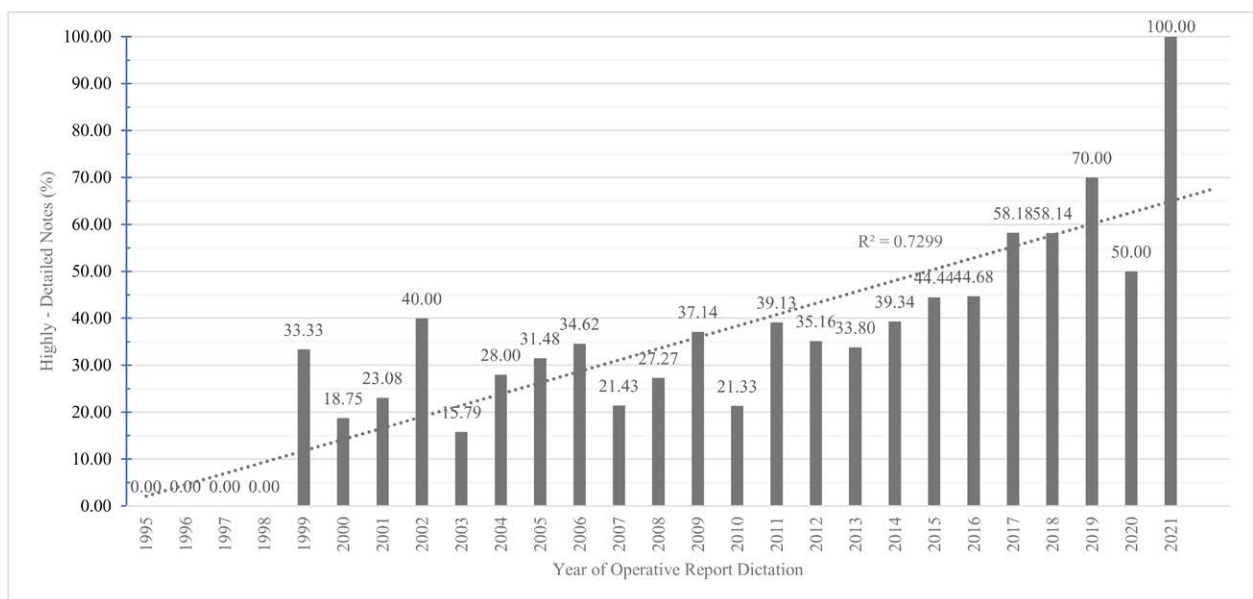
	Overall n = 1011	Poorly Detailed n = 647	Highly Detailed n = 364	P
Timing of procedure data				
Year				
Before 2010	418 (41.3%)	298 (46.1%)	120 (33.0%)	<b>&lt;0.001</b>
2010 and later	593 (58.7%)	349 (53.9%)	244 (67.0%)	
Weekday procedures 7 AM–7 PM*	617 (61%)	408 (63.1%)	209 (57%)	<b>0.005</b>
Weekday procedures 7 PM–7 AM	101 (10%)	50 (7.7%)	51 (14%)	
Weekend procedures	39 (3.9%)	24 (3.7%)	15 (4.1%)	
Same day dictation†	697 (68.9%)	449 (69.4%)	248 (68.1%)	0.680
Long duration of surgery‡	143 (14.1%)	78 (12.1%)	65 (17.9%)	<b>0.011</b>
Author demographic data				
Resident author	82 (8.1%)	45 (7.0%)	37 (10.2%)	0.073
Attending author	929 (91.9%)	602 (93.0%)	327 (89.8%)	
Gender of author				
Male	915 (90.5%)	584 (90.3%)	331 (90.9%)	0.730
Female	96 (9.5%)	63 (9.7%)	33 (9.1%)	
Degree				
MD	974 (96.3%)	627 (96.9%)	347 (95.3%)	0.200
DO	37 (3.7%)	20 (3.1%)	17 (4.7%)	
Hospital type				<b>&lt;0.001</b>
For-profit facility	95 (9.4%)	67 (10.4%)	28 (7.7%)	
Government facility	109 (10.8%)	67 (10.4%)	42 (11.6%)	
Teaching facility	543 (53.7%)	228 (35.2%)	315 (86.5%)	
Procedure-specific data				
Resident involvement	271 (26.8%)	136 (21.0%)	135 (37.1%)	<b>&lt;0.001</b>
Wound class 1	854 (84.5%)	574 (88.7%)	280 (76.9%)	<b>&lt;0.001</b>
Wound class 2	135 (13.4%)	75 (11.6%)	60 (16.5%)	
Wound class 3	62 (6.1%)	25 (3.9%)	37 (10.2%)	
Wound class 4	95 (9.4%)	51 (7.9%)	44 (12.1%)	
Concomitant procedures	234 (23.1%)	117 (18.1%)	117 (32.1%)	<b>&lt;0.001</b>
Surgical approach				<b>&lt;0.001</b>
Open, mesh	623 (61.6%)	376 (58.1%)	247 (67.9%)	
Open, suture	129 (12.8%)	107 (16.5%)	22 (6%)	
MIS, mesh	251 (24.8%)	159 (24.6%)	92 (25.3%)	
MIS, suture	8 (0.8%)	5 (0.8%)	3 (0.8%)	

Statistically significant values are in bold.

\*Not all reports had dictation time, total = 749, poorly detailed = 477, and highly detailed = 272.

†Not all reports had dictation date, total = 912, poorly detailed = 588, and highly detailed = 324.

‡Defined as procedure taking longer than 180 minutes.



**FIGURE 1.** Operative report quality over time.

**TABLE 2.**  
Association of Operative Report Quality and Postoperative Outcomes

Outcome	Total (n = 1011)	Poorly Detailed (n = 647)	Highly Detailed (n = 364)	P
Surgical site infection	113 (11.2%)	86 (13.3%)	27 (7.4%)	<b>0.004</b>
Recurrence	628 (62.1%)	428 (66.2%)	200 (54.9%)	<b>&lt;0.001</b>
Reoperation	739 (73.1%)	513 (79.3%)	226 (62.1%)	<b>&lt;0.001</b>
Readmission	734 (72.6%)	509 (78.7%)	225 (61.8%)	<b>&lt;0.001</b>
Death	2 (0.2%)	1 (0.2%)	1 (0.3%)	0.170

Statistically significant values are in bold.

**TABLE 3.**  
Full and Reduced Stepwise Logistic Regression to Identify Variables Associated With Highly Detailed Operative Notes

	Full Regression		
	Odds Ratio	95% Confidence Interval	P
Year of operative note			
Before 2010	0.078	0.55–1.12	0.182
Long duration	1.470	0.95–2.29	0.086
Resident case	1.981	1.31–3.01	<b>0.001</b>
Same day dictation	0.970	0.67–1.40	0.871
Resident dictation	1.206	0.59–2.44	0.602
Teaching hospital	1.365	0.97–1.91	0.070
Male surgeon	0.602	0.33–1.11	0.104
MD	2.278	0.99–5.22	0.052
Concomitant procedure	1.979	1.32–2.98	<b>0.001</b>
Wound class			
Contaminated	1.266	1.05–1.53	<b>0.015</b>
Operative approach			
Laparoscopic	Ref	0.24–3.93	Ref
Robotic	0.977	0.22–1.12	0.974
Converted to open	0.499	0.16–3.02	0.093
Hybrid	0.700	0.46–1.10	0.633
Open	0.712		0.126
Mesh use	3.588	1.89–6.82	<b>&lt;0.001</b>
Reduced stepwise regression			
Resident case	1.923	1.34–2.77	<b>&lt;0.001</b>
Teaching hospital	1.456	1.05–2.02	<b>0.024</b>
Wound class			
Contaminated	1.243	1.04–1.49	<b>0.020</b>
Concomitant procedure	1.975	1.33–2.94	<b>0.001</b>
Mesh used	3.648	1.98–6.72	<b>&lt;0.001</b>

Statistically significant values are in bold.

**TABLE 4.**  
Full Regression With Each Outcome Included

Outcome	Odds Ratio	95% Confidence Interval	P
Surgical site infection	0.268	0.14–0.50	<b>&lt;0.001</b>
Readmission	0.553	0.38–0.80	<b>0.002</b>
Recurrence	0.802	0.57–1.13	0.212
Reoperation	0.506	0.35–0.74	<b>&lt;0.001</b>
Death	1.188	0.07–19.58	0.904

Statistically significant values are in bold.

but should have worse outcomes. However, the inverse was true suggesting that surgeons dictating highly detailed operative reports were able to overcome case complexity. Surgeons who have highly detailed operative reports may simply be more detail-oriented surgeons which could yield superior clinical outcomes. Surgeons who document these clinical details may be more cognizant and actively aware of these clinical details intraoperatively. Utilizing the Bradford Hill criteria for causation, this study and relationship meets at least 4 of the 9 criteria.<sup>21</sup> Additional studies are necessary to validate these findings. Similar studies in other fields and specialties would strengthen the generalizability and argument for causation. In addition, prospective studies such as prepost study, step-wedge trial, or even cluster randomized controlled trial could confirm the causative nature of operative note detail and clinical outcomes.

We found that highly detailed operative reports were more common in teaching hospitals with residents involved in cases, complex cases, and when mesh was used. Teaching hospitals with residents may be more detail-oriented as a part of teaching, more likely to be actively engaged in research on surgical diseases, and more focused on up-to-date details and guidelines. Additionally, teaching hospitals may simply have more eyes reviewing documents and get double-checked and edited more often. Complicated cases were associated with highly detailed operative reports. This may be because these complex cases are performed by specialists. Or, in complicated settings, surgeons are more meticulous in their reporting as compared to simpler or more routine cases.

As the development and subsequent implementation of templated operative reports become more common across the healthcare industry, it is imperative that these templates and standards be developed with an adequate amount of detail and quality. Including these details as part of the template structure or format may increase operative report quality, which may, in turn, improve clinical outcomes. It is plausible that by mandating more detailed templates, surgeons are more likely to be aware of and pay attention to these key intraoperative details.

There are several limitations to this study. Although efforts were made to improve the generalizability of this study, it may be improved by expanding to other surgical procedures and medical specialties. This was a retrospective study and causality cannot be assumed. A significant limitation of the study is that the operative reports included were from a medical-legal database thus all patients included had a complication

literature in other fields. A study by Kanters et al<sup>17</sup> found that only 39% of colorectal narrative operative reports contained all required elements. However, the same study found that 92% of synoptic operative reports contained all the required elements. Several other fields, including pathology and surgical oncology, have implemented synoptic reporting and have shown that it improves documentation.<sup>18,19</sup> The move to synoptic reporting in cancer surgery came after several studies showed gaps in quality of care such as high rates of positive margins and inadequate lymph node exams.<sup>17,20</sup> This led to the standardization of documentation in cancer surgery operative reports. Our study correlating poorly detailed VHR operative reports with worse patient outcomes begs the question: should synoptic reporting be implemented in other surgical fields to improve outcomes?

To our knowledge, this is the first study correlating highly detailed operative reports with better patient outcomes. It is unclear if the relationship between detail of operative reports and clinical outcomes is purely associative. However, it would seem plausible that this relationship is causative. More complex cases were associated with highly detailed operative reports



following one of their operations. The patients in our sample had a higher rate of complications than is generally reported in the literature. For example, the recurrence rate in our sample was 62% compared to 6%–40% in the literature.<sup>1,22–24</sup> For this reason, our sample of operative notes may not be representative of all VHR in the United States. Future studies should be performed to confirm and validate the results identified in this study.

## CONCLUSION

In this medico-legal dataset, the majority of VHR operative reports lack adequate detail. Operative reports that have higher levels of detail are associated with lower rates of recurrence, reoperations, readmissions, and SSIs. These findings may favor the development and subsequent implementation of a standardized operative report template for VHR to potentially improve patient outcomes, however, our findings must first be validated using nationally representative datasets containing operative notes.

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