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Secular trends in small-bowel obstruction and adhesiolysis in the United States: 1988–2007

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Abstract

BACKGROUND: Postoperative adhesions are common after surgery and can cause small-bowel obstruction (SBO) and require adhesiolysis. The impact that laparoscopy and other surgical advances have had on rates of SBO and adhesiolysis remains controversial. This study examines trends in discharges from US hospitals for SBO and adhesiolysis from 1988 to 2007.

METHODS: We performed an analysis of secular trends for SBO and adhesiolysis, using the National Hospital Discharge Survey. Spearman correlation coefficients were calculated to assess trends over time.

RESULTS: Rates of SBO were stable over time ($\rho = .140$; $P = .28$). Adhesiolysis rates were stable over time ($\rho = -.18$; $P = .17$), although there were significant downward trends in patients older than age 65 ($\rho = -.55$; $P = .01$) and age 15 to 44 ($\rho = -.84$; $P < .01$).

CONCLUSIONS: There has been no significant change in overall rates of SBO or adhesiolysis from 1988 to 2007. For adhesiolysis, there were decreasing trends when stratified by age. Further research is required to understand the factors associated with adhesion-related complications.

Adhesions are fibrous connections that develop in response to trauma or surgical interventions involving the intraperitoneal cavity. These fibrous bands are thought to occur in up to 93% of patients undergoing an intra-abdominal surgical procedure.[1–4] Adhesion formation can result in significant morbidity and mortality, including small-bowel obstruction (SBO) and infertility in women.[4–6] Adhesion-related complications also are responsible for up to 74% of cases of SBO in adults[7] and 30% of re-admissions at 4 years after an incident intra-abdominal surgery.[8] Such complications constitute a substantial amount of health care spending.[9–11] The incidence of small-bowel obstruction and other adhesion-related complications is thought to vary significantly with surgery type, with surgery involving the small or large bowel resulting in higher rates of this complication compared with those involving the foregut.[12]

In recent decades, there has been a dramatic increase in laparoscopic intra-abdominal surgery. However, it is unknown whether this has translated into fewer postoperative complications as a result of adhesions. A 2004 review of 11

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experimental studies involving animal models and 4 studies involving human beings described decreased rates of adhesion formation after laparoscopy, but there was significant heterogeneity among the human studies.[13] Furthermore, some evidence suggests that this decrease in adhesion formation has not necessarily translated to a decrease in adhesion-related obstruction. For example, in a recent randomized multicenter trial comparing outcomes in laparoscopic versus conventional approaches in colorectal surgery for malignancy, there was no difference between the 2 groups in obstruction-related complications at 3 years of follow-up evaluation.[14]

In addition to the growing use of laparoscopy, there have been multiple barrier agents introduced to prevent adhesions. These agents include physical barriers such as hyaluronic acid and carboxymethylcellulose (Seprafilm: Genzyme, Cambridge, MA), oxidized regenerated cellulose (Interceed: Ethicon, Cornelia, GA), expanded polytetrafluoroethylene (Preclude: Gore, Flagstaff, AZ), and topical gels such as SprayGel: Confluent Surgical, Waltham, MA. Although these agents appear to decrease adhesions overall, there is conflicting evidence with regards to their efficacy in decreasing the rate of SBO over time,[15–17] and as such their use has been limited.

The impact that increasing use of laparoscopic methods and barrier agents have had on rates of obstruction and adhesiolysis in routine clinical practice remains unexplored. If laparoscopy or barrier agents are effective in reducing rates of adhesion formation, one would expect a decreasing rate of bowel obstruction and adhesiolysis as these surgical techniques become more common. Therefore, in this study we examined rates of discharges from US hospitals for small-bowel obstruction and adhesiolysis from 1988 to 2007, using population-based data from the National Hospital Discharge Survey (NHDS).

Methods

Data source

The NHDS, which has been conducted since 1965, abstracts medical and demographic information such as sex, age, race, marital status, length of stay, up to 7 diagnosis codes and 4 procedural codes, hospital region, and payer data from nonfederal, short-stay hospitals in the United States.[18] There were 5,983 to 8,017 hospitals meeting the eligibility criteria to participate in the NHDS during the study period. From these, the NHDS samples approximately 500 to 550 hospitals each year, and approximately 450 hospitals respond to survey requests. Initially, NHDS data were recorded manually onto predefined data collection sheets by National Center for Health Statistics staff, US Bureau of the Census staff, and local hospital employees. Since 1985, some hospitals have used computer-based data collection. The method of data collection was not recorded in the final data set. The primary sampling unit is considered to be geographic area, and hospitals are selected within each primary sampling unit, with probabilities proportional to their annual number of discharges.

NHDS data are collected in a stratified, multistage probability design, using a 3-stage sampling plan that was implemented in 1988, making comparisons between data collected from 1965 to 1987 and after 1987 difficult to interpret because trends may be the result of modified sampling procedures as opposed to actual changes in rates. As such, this study only used data from 1988 to 2007.

Diagnosis and procedure codes are recorded in the NHDS data using the International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM). Application of sampling weights allow for extrapolation to US population-based estimates of rates of hospitalization for a given diagnosis for each year.[18]

Inclusion criteria

Hospital discharges for individuals older than age 15 years were selected via appropriate diagnostic and procedural codes for SBO and adhesiolysis. We excluded children younger than age 15 because the etiology of SBO in children often is different from that in adults. This also allowed us to conform to the predefined methods for assessing standard error and relative standard error of the survey data, using constants provided with the dataset.[18] These constants are available for age groups predetermined by the NHDS: 15 to 44 years, 45 to 64 years, and age 65 years and older.

ICD-9-CM codes 560.81, 560.89, and 560.9 were used to identify SBO. These same ICD-9-CM codes were used during the entire study period for these diagnoses. For adhesiolysis, ICD-9-CM codes 54.51 (laparoscopic lysis of peritoneal adhesions) and 54.59 (other lysis of peritoneal adhesions) were selected. Of note, before 1996, the code for adhesiolysis was 54.5, with the change likely representing increased use of laparoscopic techniques. As such, this code was used from 1987 to 1996. For both SBO and adhesiolysis codes, our primary analysis looked at the presence of one of these codes at any diagnostic code (1–7) or procedural code (1–4) position. As a secondary analysis, we assessed for the presence of these codes in only the first diagnostic or procedure code position because this most likely would represent the primary reason for admission.

Because postoperative complications only occur in patients with prior surgery, we also examined trends in intra-abdominal surgeries over the same time period. We used 366 ICD-9-CM codes to identify any intra-abdominal surgery other than adhesiolysis (Appendix I). Because some surgeries may be performed as outpatient procedures, we also examined trends for partial or total colectomy because these surgical procedures typically are associated with admission.

The association of adhesiolysis at the time of another intra-abdominal surgery also was assessed. To perform this