Portosystemic Shunts: Stable Utilization and Improved Outcomes, Two Decades After the Transjugular Intrahepatic Portosystemic Shunt

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Abstract

Purpose: The aim of this study was to assess national trends in utilization, demographics, hospital characteristics, and outcomes of patients undergoing surgical or percutaneous portal decompression since the introduction of transjugular intrahepatic portosystemic shunts (TIPS).

Methods: A retrospective analysis of patients undergoing surgical portal decompression and TIPS procedures was conducted using Medicare Physician/Supplier Procedure Summary Master Files from January 2003 through December 2013 and National (Nationwide) Inpatient Sample data from 1993, 2003, and 2012. Utilization rates normalized to the annual number of Medicare enrollees, estimated means, and 95% confidence intervals were calculated.

Results: The Medicare total annual utilization rate per million for all portosystemic decompression procedures decreased by 6.5% during the study period, from 15.3 in 2003 to 14.3 in 2013. TIPS utilization increased by 19.4% (from 10.3 to 12.3 per million), whereas open surgical shunt utilization decreased by 60.0% (from 5.0 to 2.0 per million). TIPS procedures represented 86% of all procedures in 2013. From 1993 to 2012, mean age increased slightly (from 53.0 to 55.5 years, $P < .05$). The percentage of procedures performed at teaching hospitals increased, whereas in-hospital mortality and length of stay decreased by 42% ($P < .05$) and 20% ($P < .05$), respectively. Of factors evaluated, the performance of procedures on an elective basis was the most influential on in-hospital mortality ($P < .01$, all years studied) and length of stay ($P < .0001$, all years studied).

Conclusions: Approximately two decades after the introduction of TIPS, the utilization of all portal decompression procedures has remained relatively stable. The TIPS procedure represents the dominant portal decompression technique. In-hospital mortality and mean length of stay after decompression have decreased, partially because of the performance of procedures during elective admissions.

Key Words: Transjugular intrahepatic portosystemic shunt, TIPS, portal decompression, portal hypertension, utilization trends, interventional radiology

J Am Coll Radiol 2015;12:1427-1433. Copyright © 2015 American College of Radiology

INTRODUCTION

In 1902, Gilbert [1] coined the term *portal hypertension* to describe structural changes in the portal circulation that could cause gastrointestinal bleeding. Portal decompression procedures can be lifesaving for patients who have complications of portal hypertension, such as variceal bleeding or ascites that cannot be controlled with endoscopic or medical treatments. Vidal [2] used a portacaval shunt for the first time in a human in 1903; the patient lived for 4 months after the surgery [3]. Nonselective shunts, such as portacaval or mesocaval shunts, decompress the entire portal system by diverting all portal blood flow but are generally associated with a higher risk for hepatic encephalopathy and liver failure [4]. Selective shunts, such as the distal splenorenal shunt (DSRS), were first introduced by Warren in the 1960s [5]. Selective shunts attempt to preserve some portal flow while decompressing varices [6]. Overall, the various types of surgically created shunts provide >90% control of variceal bleeding and carry similar survival rates [5,7-9].

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Dr Kwan is supported by grant KL2 TR000421 from the National Institutes of Health, National Center for Advancing Translational Sciences. The funders/sponsors had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

The authors have no conflicts of interest related to the material discussed in this article.

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1546-1440/15/$36.00 ■ http://dx.doi.org/10.1016/j.jacr.2015.06.037

The concept of a percutaneously inserted metallic shunt for portosystemic decompression was originally described by Rosch et al [10] in 1969, but the first human case of transjugular intrahepatic portosystemic shunt (TIPS) creation was not reported until 1989 [11]. The first large series of patients who underwent TIPS procedures followed soon after, in 1993 [12]. TIPS placement technique was further advanced in the early 2000s with the introduction of expanded polytetrafluoroethylene—covered stent grafts, which have improved patency [13-15].

It is widely believed that the TIPS procedure is now the most commonly performed portal decompression procedure. This has been shown using data from a single state [16,17], but not at the national level. It is also not known what effects, if any, the introduction of a minimally invasive alternative to surgical decompression has had on the clinical and hospital setting where portal decompression surgery is performed and on patient outcomes at a population level. The purposes of this study therefore were to (1) report on long-term national trends in the utilization of portal decompression procedures and (2) evaluate temporal trends in patient demographics, hospital characteristics, and outcomes of patients who underwent portal decompression since the advent of TIPS.

METHODS

To assess long-term national utilization trends, Medicare provider claims from the Physician/Supplier Procedure Summary (PSPS) Master Files from 2003 through 2013 were obtained from CMS. These files aggregate claims information for all patients with Medicare Supplemental Medical Insurance (Medicare Part B). PSPS claims data were extracted at two-year intervals between 2003 and 2013 using Current Procedural Terminology codes for the following portal decompression procedures: open portacaval shunt, open renoportal shunt, open caval-mesenteric shunt, open splenorenal shunt (proximal), open splenorenal shunt (distal), and transvenous intrahepatic portosystemic shunt insertion. Utilization rates were normalized to the annual number of Medicare Part B enrollees [18] and are reported as the number of procedures per million enrollees. To assess temporal trends in utilization, percentage change over time was calculated for the normalized utilization numbers for each calendar year. This part of our study involved a similar methodology to that described for other studies of national trends in procedural utilization [19-22].

To evaluate trends in patient demographics and outcomes and characteristics of hospitals at which portal decompression procedures were performed, we obtained National (Nationwide) Inpatient Sample (NIS) data from the Healthcare Cost and Utilization Project (HCUP) database from 1993, 2003, and 2012. NIS is the largest publicly available all-payer inpatient health care database in the United States. NIS contains data on patient demographics, clinical outcomes, hospital characteristics, and resource utilization for 20% of hospital stays in the United States, which equates to more than 7 million hospitalizations a year. All patients who underwent portal decompression procedures were identified with the International Classification of Diseases, ninth rev, Clinical Modification code for intra-abdominal venous shunt (39.1). Sampling weights provided by HCUP were used to produce estimates of population means and 95% confidence intervals (CIs) for the total number of patients in the United States who underwent portosystemic decompression, their demographic characteristics, characteristics of the hospitals at which the procedures were performed, in-hospital mortality, and mean length of stay (LOS). Indications for decompression were classified on the basis of diagnosis codes into variceal bleeding, ascites, variceal bleeding and ascites, hydrothorax or effusion, Budd-Chiari syndrome, cirrhosis or chronic liver disease, and other. If multiple diagnoses were identified, the most specific was used. Population estimates were considered statistically different if 95% CIs did not overlap. Regression analyses were performed using methods to account for the use of sample survey data; results were considered significant at $P < .05$.

All data analyses were performed using commercially available software (SAS version 9.3, SAS Institute Inc, Cary, North Carolina; Excel 2010, Microsoft Corporation, Redmond, Washington). Institutional review board approval was not required because these public-domain data do not involve individually identifiable health information.

RESULTS

Between 2003 and 2013, the annual utilization rate for all portosystemic shunt procedures performed in the Medicare population decreased from 15.3 to 14.3 per million enrollees, a decrease of 6.5%. The utilization rate for TIPS procedures during this time increased by 19.4% (from 10.3 to 12.3 per million) although it decreased by 60.0% for all open surgical shunts (from 5.0 to 2.0 per million). The most commonly created open surgical

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