

Identification of Accessory Spleens During Laparoscopic Splenectomy Is Superior to Preoperative Computed Tomography for Detection of Accessory Spleens

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ABSTRACT

Background: Missed accessory spleen (AcS) can cause recurrence of hematologic disease after splenectomy. The objective of the study was to determine whether detection of AcS is more accurate with preoperative computed tomography (CT) scan or with exploration during laparoscopic splenectomy.

Methods: A retrospective chart review was performed for 75 adult patients who underwent laparoscopic splenectomy for various hematologic disorders from 1999 to 2009. Preoperative CT scans were performed in all patients. Patients were followed for recurrence of disease, and a scintigraphy scan was performed in those with suspected missed AcS.

Results: The most common diagnosis was idiopathic thrombocytopenic purpura in 29 patients (39%), followed by non-Hodgkin's lymphoma in 22 patients (29%). Sixteen AcSs were found during surgery in 15 patients (20%), and preoperative CT scan identified 2 of these. Twelve AcSs were located at the splenic hilum (75%). Nine patients experienced recurrence of their disease, and none had a missed AcS on subsequent scintigraphy. Sensitivity of exploratory laparoscopy for detection of AcS was 100%, and for preoperative CT scan was 12.5% ($P = .005$).

Conclusion: Exploratory laparoscopy during splenectomy is more accurate than preoperative imaging with CT scan for detection of AcS. Preoperative CT scan misses AcS frequently and should not be obtained for the purpose of its identification.

Key Words: Accessory spleen, Laparoscopic splenectomy.

INTRODUCTION

Over the past 2 decades, laparoscopic splenectomy (LS) has become the preferred approach for the removal of a spleen in various hematologic diseases. The laparoscopic approach has been widely accepted because LS demonstrated shorter hospital stay and faster recovery in comparison to open splenectomy (OS), while keeping with the standards for morbidity and mortality.^{1,2} However, concerns were initially raised about the effectiveness of LS to detect and remove accessory spleens (AcS).³ This posed a dilemma for surgeons because a missed AcS can cause recurrence of hematologic disease after splenectomy. These fears were later alleviated by studies that found no difference between LS and OS with respect to the rate of identification of AcS.^{4,5}

The incidence rate of AcS is reported to be 5% to 44%.⁶⁻⁹ This wide range of the reported incidence exists due to the different methods of identifying AcS, such as preoperative imaging, exploration during OS or LS, and autopsy findings. The incidence rate is also dependent on the proportion of patients in the study that carry the diagnosis of immune thrombocytopenic purpura (ITP), because the presence of AcS is more frequent in this patient population.⁹⁻¹¹ Based on the published literature, a consensus has not been reached regarding the best method for detection of AcS. Preoperative computed tomography (CT) of the abdomen and pelvis has been argued for as an accurate method of detecting AcS preoperatively.^{12,13} Others have reported that exploratory laparoscopy is superior to preoperative CT scan.^{14,15}

With the increased use of CT over the past several decades, concerns are mounting about radiation exposure and the risk of subsequent malignancies.^{16,17} Moreover, the rising costs of health care have also gained widespread attention, and many authorities aim to curtail unnecessary use of technology in medicine.¹⁸ The purpose of this study was to evaluate the efficacy of CT scan and

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exploratory laparoscopy in detection of AcS to determine if preoperative CT scans are beneficial.

METHODS

We performed a retrospective review of a prospectively collected database for all LS performed on adult patients at our academic tertiary care center from January 1999 to September 2009. Patients who were younger than 18 y or had splenectomy in the setting of trauma, bleeding varices, or another major procedure were excluded. All patients underwent preoperative imaging with CT of the abdomen and pelvis with intravenous contrast. Approval from the Institutional Review Board was obtained prior to review of the database.

Seventy-five patients with a variety of diagnoses were identified. Twenty-two of these patients fit the criteria for massive splenomegaly, defined by either a craniocaudal length ≥ 17 cm or a weight ≥ 600 g. During this period of time, 34 OS procedures were performed, and the decision to proceed with either a laparoscopic or open approach depended on surgeon preference. The data on 34 OS procedures will not be presented in this manuscript.

All patients were given standard vaccinations at least 2 wk prior to surgery, and intravenous first-generation cephalosporin was administered within 1 h of incision time. A thorough search for AcS was performed before removal of the spleen. This approach did not change significantly over the course of the study. Splenocolic, splenorenal, and gastrosplenic ligaments, along with the greater omentum, were carefully inspected. A search in the left paracolic gutter and the pelvis was done next. If the spleen was normal-sized or only mildly enlarged, the hilum of the spleen and the area of the pancreatic tail were inspected at that time. If the spleen was massive, dissection of the ligaments was undertaken, and the hilum, along with the pancreatic tail, were inspected at a time when access to them was more readily available. If AcS was identified, it was removed separately from the main specimen via a retrieval bag. Normal-sized spleens were removed via a retrieval bag through a 12-mm trocar site. Massive spleens were either morcellated while in the retrieval bag or removed through an accessory incision. Re-exploration of the left upper quadrant was done once the specimen was extracted.

With respect to the CT scan, a 5-mm slice thickness was used, and only the arterial perfusion phase was implemented. No coronal or sagittal reformations were obtained. Only radiologists experienced in body imaging

reviewed the scans. No detection size of AcS was required for CT scan, and the surgeon was not blinded to the results.

All patients were followed up initially by the surgeon and afterwards by the hematologist. Patients who did not develop a hematologic response, which was manifested by persistent or recurrent thrombocytopenia, underwent radioactive colloid scan to detect missed AcS. Study outcomes were patient demographics, diagnoses, operative outcomes, and locations and number of AcS. Data were expressed as a mean or as a percentile. The number of AcS in the cohort was determined from preoperative CT scan, exploratory laparoscopy, and postoperative colloid scan in cases of a failed hematologic response. Sensitivity, specificity, positive predictive value, and negative predictive value for CT scan and exploratory laparoscopy for identification of AcS were calculated. The sizes of AcS were not always reported by pathologists and were not analyzed.

Statistical analysis was performed using the χ^2 test and Fisher's exact test. A P value < 0.05 indicated statistical significance.

RESULTS

Demographics for 75 patients are displayed in **Table 1**. Nine patients (12%) had a minor complication, and one (1.3%) required a reoperation due to an iatrogenic injury to the stomach, necessitating a partial gastrectomy. There was no mortality. Twelve of 75 (16%) patients required a conversion. Eight conversions were due to failure to control bleeding, and 4 were secondary to the inability to complete the operation laparoscopically. Six conversions occurred in nonmassive and 6 in massive spleens, for a rate of 11.3% and 27.3%, respectively.

The indications for performing splenectomy are listed in **Table 2**. The most common diagnosis was ITP in 29 patients (39%), followed by non-Hodgkin's lymphoma in

Table 1.
Patient Demographics for 75 Patients

Demographic	No. (%)
Age (mean years)	59
Male/female	35/40 (46.7%)
ASA ^a classification	2.5
Malignant diagnosis/benign diagnosis	25/50 (36.0%)

^aASA = American Society of Anesthesiologists.

Table 2.

Diagnosis and Incidence of Accessory Spleens

Diagnosis	No. of Patients 75	No. of Accessory Spleens 16
Benign		
ITP ^a	29	5
Benign mass	6	1
Hereditary spherocytosis	3	2
Hypersplenism	2	2
AIHA ^a	2	0
Myelofibrosis	2	0
Cyst	2	0
Red cell membrane defect	1	1
Abscess	1	0
Malignant		
Non-Hodgkin's lymphoma	22	4
Chronic lymphocytic leukemia	2	1
Hairy cell leukemia	1	0
Other	2	0

^aITP=idiopathic thrombocytopenic purpura; AIHA=autoimmune hemolytic anemia.

22 patients (29%). Sixteen AcSs were identified during exploratory laparoscopy in 15 patients (20%). A single patient with hereditary spherocytosis had 2 AcSs, while the other 14 patients had 1 AcS identified. Twelve of the 16 AcSs (75%) were found near the hilum of the spleen, 2 (12.5%) in the greater omentum, 1 (6.3%) in the gastrosplenic ligament, and 1 (6.3%) in the splenicocolic ligament. Nine AcSs (17%) were identified in nonmassive and 7 AcSs (27.3%) in massive spleens ($P = .35$).

Two AcSs in 2 patients (2.7%) were detected on preoperative CT scan with their location being in the hilum of the spleen, and both were found intraoperatively. Nine patients, all with ITP, did not have a hematologic response postoperatively, with persistent or recurrent thrombocytopenia. All 9 patients underwent a radioactive colloid scan, but no missed AcSs were found. Seven scintigraphy scans were done within 6 mo of the surgery, and 2 were done 1 y and 2 y after the surgery. The failed hematologic response in these patients was attributed to incomplete response of ITP to splenectomy, not a missed AcS. These patients did not undergo a reoperation.

Based on the above findings, the total number of AcS was 16 in 15 patients. Predictive values for CT scan and ex-

Table 3.

Computed Tomographic (CT) Scan and Exploratory Laparoscopy for Detection of Accessory Spleen

	Sensitivity (%)	Specificity (%)	PPV ^a	NPV ^a
CT scan	12.5	100	100	19.2
Laparoscopy	100	100	100	100

^aCT=computed tomography; PPV=positive predictive value; NPV=negative predictive value.

ploratory laparoscopy were calculated and are displayed in **Table 3**. The difference in sensitivity between CT scan and exploratory laparoscopy reached significance ($P = .005$).

DISCUSSION

A missed AcS can lead to a failed hematologic response, especially in cases of ITP. As experience with the laparoscopic approach has grown, surgeons' ability to find AcS during exploratory laparoscopy has matched that of exploratory laparotomy.⁴⁻⁶ However, failures to find AcS during surgery still occur.^{14,15}

Most AcS are located near the splenic hilum,^{7,14} while many others are found readily in the left upper quadrant within the operative field.¹⁹⁻²¹ These sites include the splenic ligaments and the tail of the pancreas. In our study, 14 of 16 AcS (87.5%) were located within the operative field. Yet, there are more rare and remote locations, such as the greater omentum, mesocolon, pelvis, and testis, which have also been documented as sites for AcS.^{8,22,23} We detected 2 AcSs during exploratory laparoscopy in the greater omentum by careful inspection and palpation. Both patients had been diagnosed with ITP. We believe that detection of AcS in more remote locations can be successful with the laparoscopic approach, but requires patience on the part of the surgeon who must perform a meticulous search.

The published literature is filled with controversy regarding the accuracy of preoperative imaging and the intraoperative detection of AcS. Gigot et al.³ reported experience with preoperative CT scan, scintigraphy, and exploratory laparoscopy that questioned the accuracy of all 3 modalities. In a study of 18 patients, the rates of detection were 25% for both CT scan and scintigraphy, while it was 75% for exploratory laparoscopy. CT scan was performed after intravenous and oral contrasts were administered with 8-mm slice thickness. The incidence rate of AcS was determined to be 41%, and to our knowledge, is one of the

highest in published literature for laparoscopic splenectomy. Two late recurrences were associated with postoperative residual accessory tissue, but the patients did not undergo reexploration to rule out the presence of AcS. This suggests that the incidence rate in this group of 18 patients may have been as high as 53%. Another unusual finding from this study was the high rate (50%) of residual splenic tissue detected with postoperative scintigraphy. The high incidence rates of AcS and residual splenic tissue have not been reproduced in other publications and may need to be weighed against the authors' conclusion that elective LS for hematologic diseases does not allow for complete detection of AcS.

The same authors came to a different conclusion with respect to CT scan in a later study, where the detection rate was 100%, and was attributed to the development of high-resolution CT technologies.¹² These results were supported by a later publication by Napoli et al.¹³ who found that preoperative multidetector row CT correctly predicted the sites of 3 AcSs in a group of 22 patients. Triphasic helical CT protocol was used with 1-mm slice thickness, along with oblique coronal and sagittal image reconstruction. The authors reported that intraoperative and imaging findings were identical and concluded that the sensitivity of AcS detection by CT scan was 100%. However, CT scan only visualized the upper abdomen from the diaphragm to the caudal aspect of the spleen. The greater omentum, mesocolon, and pelvis were not analyzed by CT scan or exploratory laparoscopy. Also, no follow-up data were provided. It is likely that the lack of follow-up and the absence of imaging of the entire abdomen and pelvis did not allow for assessment of false-negative results, and the sensitivity of CT scan was overestimated.

Several reports have focused on the use of a handheld γ probe to decrease the risk of failure of the operation.^{19,21} Barbaros et al.¹⁹ performed preoperative ultrasound, spiral CT, and scintigraphy on 17 patients. After splenectomy was completed, a handheld γ probe was used to look for AcS and helped find a previously unidentified AcS in the retroperitoneum over the upper pole of the kidney. For 2 patients, exploratory laparoscopy and handheld γ probe did not identify AcS, even though preoperative CT scan did. The sensitivities in this study were 0% for ultrasound, 75% for CT scan, 0% for preoperative scintigraphy, 75% for laparoscopy, and 100% for γ probe. Despite these results, this approach has not gained popularity.

A consensus statement by the European Association of Endoscopic Surgery (EAES) has recommended the use of

preoperative CT scan in addition to a thorough intraoperative search for AcS to achieve the highest detection rates.²⁴ However, multiple recent reports have come to different conclusions. In a study of 105 splenectomies, 54 open and 51 laparoscopic, 12 AcSs were found intraoperatively, and 5 missed AcS were detected postoperatively. None of these were identified with preoperative CT scan or ultrasound, although not all patients underwent imaging studies.⁴ Stanek et al.¹⁴ reported results for 58 patients with ITP who underwent preoperative spiral CT and ultrasound. Sensitivities for ultrasound, CT scan, and laparoscopy were 0%, 43%, and 86%, respectively. Lastly, Quah et al.¹⁵ reported results for a group of 58 patients, in which a total of 15 AcS were found in 13 patients (22%). The sensitivity for laparoscopy and contrast-enhanced CT scan was 93% and 60%, respectively. The authors concluded that preoperative CT scan for the detection and localization of AcS may not be necessary, and a thorough search for AcS during exploratory laparoscopy remains the most successful method of its detection. The results of our study support this conclusion, as the sensitivity for CT scan and exploratory laparoscopy was 12.5% and 100%, respectively.

The incidence rate of AcS in our group of patients was 20%. This falls within the reported incidence rate of 5% to 44% and compares favorably to recent reports that evaluated large numbers of patients.⁶⁻⁹ In a multicenter study, Casaccia et al.²⁵ reported data from a retrospective review of 309 patients who underwent LS for hematologic diseases. Accessory spleens were found in 25 patients (8%). In an autopsy series of 720 consecutive patients with no history of hematologic diseases, 54 AcS were found in 48 cases (6.7%).⁸ Park et al.⁶ reported on outcomes of LS performed for hematologic diseases in 203 patients. Thirty AcS were identified in 25 patients (12.3%). Lastly, Mortelet et al.⁷ examined the accuracy of contrast-enhanced CT scan for the detection of AcS in 1000 consecutive patients, and 156 patients with AcS were identified (15.6%).

Considering the growing experience with exploratory laparoscopy and improved detection of AcS intraoperatively, there seems to be no clear benefit to a preoperative CT scan. Firstly, most AcS are located within the operative field and are readily identified there. In a large study of 720 autopsy cases, only 2 of 54 AcS were found remotely in the pelvis.⁸ Secondly, concerns have been raised for increasing risk of radiation exposure due to the more frequent use of CT.^{16,26} Thirdly, recent attention has been given to the oftentimes unnecessary use of technology in medicine and how it contributes to health care costs.¹⁸ Lastly, even if AcS is missed intraoperatively, it is readily

identified on postoperative radioactive colloid scan and can be removed laparoscopically.²⁰ Taking all of these considerations together, the benefit of CT scan does not appear to overcome its potential risks and costs. Furthermore, the result of a preoperative CT scan, whether negative or positive, does not eliminate the need to perform a thorough intraoperative search for AcS.^{3,4,14,15,24}

CONCLUSION

Our experience indicates that exploratory laparoscopy is more accurate than preoperative CT scan in the detection of AcS. The benefit of the imaging modality is also limited by radiation exposure and costs. We believe that CT scan for the purpose of identification of AcS should not be obtained, and instead, a thorough intraoperative search for AcS should be performed.

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