The Need for Visits to Social and Vocational Programs for the Mentally Ill as Part of General Psychiatry Residency Training

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Abstract

Background. Comprehensive treatment planning for psychiatric illnesses should be based on a biopsychosocial model of treatment to address the acuity and chronicity of these disorders. To achieve this goal, knowledge about pharmacological, psychological, and social aspects of the treatment plan should be presented as an integral part of general psychiatry residency training. This survey study was conducted to examine how many programs provide training where residents have scheduled visits to social and vocational mental health service organizations in the community and to identify potential obstacles to including this rotation in general psychiatry residency training.

Methods. A voluntary, anonymous survey was sent via SurveyMonkey® to the program directors of all general psychiatry residency programs in the United States. The survey consisted of five questions designed to assess if their programs had a rotation where residents visit social and vocational programs in the community designed for mentally ill patients to provide knowledge of the community mental health resources to their residents.

Results. Of the 168 survey invitations issued, 73 (44%) responded. Fifty-six responders acknowledged that their residents were required to visit a community mental health organization, but their programs did not offer visits to community social and vocational programs. Seventeen program directors reported that their program did not provide this experience to their residents and indicated a desire to include such a rotation.

Conclusions. Community mental health service organization visits should enhance knowledge of psychiatry residents about community mental health resources and indirectly promote better patient care. Information obtained from this survey should create discussion to work toward better psychiatric resident training.

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Introduction

The management of patients with mental illness is multifaceted and involves the understanding of biopsychosocial factors contributing to the acuity and chronicity of the illness. Although many talk about the biopsychosocial model, few practice it regularly.[1] In an era of managed care, when inpatient hospitalization is getting shorter, and recovery-oriented mental health care has become predominant, it makes sense to acquire knowledge about the tools used to provide social interventions. Therefore, the training of a psychiatrist must provide knowledge about the biological and psychological treatment options and social interventions which are an integral part of the biopsychosocial treatment model to treat psychiatric conditions.

The Accreditation Council for Graduate Medical Education (ACGME) is the major organization regulating residency training programs throughout the United States. The concept of the biopsychosocial model is central to the ACGME Program Requirements for Graduate Medical Education in Psychiatry.[2] Indeed, programs must annually evaluate residents in the Postgraduate (PG)-2, PG-3, and PG-4 years and "conduct and examination across biological, psychological, and social spheres**…".** ACGME requirements for community psychiatry training within the United States states that "this experience must expose residents to persistently and chronically-ill patients in the public sector (e.g., community mental health sectors, public hospitals and agencies, and other community-based settings). The program should provide residents the opportunity to consult with, learn about, and use community resources and services in planning patient care, as well as to consult and work collaboratively with case managers, crises teams, and other mental health professionals."

Despite these recommendations from ACGME, most psychiatric training programs emphasize psychopharmacology, laboratory values, and imaging studies as part of the "biological" approach to treating mental illness. Psychiatrists may feel that they are marginalized as persons who only prescribe medications, therefore, are following a reductionist approach in the treatment of their patients.[3]

In 1986-1987, the American Association of Community Psychiatrists (AACP) conducted a survey of psychiatry residency training programs, which gathered data regarding current practices and trends in training residents in "social, community, or public" aspects of psychiatry.[4] Using a checklist format, they asked residency programs about clinical settings used for training, treatment modalities, patient populations, and topics covered in didactic coursework. The survey focused primarily on the existence of an "identifiable program of social and community psychiatry" as part of the clinical rotation. Survey results indicated that 92% of the respondent programs had some form of community mental health center available for training.

A more intensive model called the "public psychiatry module" was developed in 1991 at the University of Miami Medical School.[5] They pointed out that "a rotation in a community mental health center (CMHC) may not adequately educate residents about the interlocking network of services available to patients and the large array of elements necessary for an effective continuum of care." Sobhan et al.[6] concluded that "residents would need more than a rotation of 6 months' duration in a community mental health center to learn about the interlocking network of services available to patients and the large array of elements necessary for an effective continuum of care."

Emphasizing the social aspect of treatment is long overdue. Each ACGME-accredited psychiatry residency training program has developed its own unique systems of providing their residents with this experience. Some training programs may approach it by imparting theoretical knowledge in the form of didactics and involving the social worker in a typical inpatient-based treatment planning alongside residents. However, it is doubtful if this approach can match real-life exposure to diverse service delivery settings available in the community that truly reflect the complex systems involved in the treatment of mentally ill people.

At the University of Kansas School of Medicine-Wichita, monthly scheduled educational tours to different community mental health service organizations focus on

the social and vocational programs in the community specifically designed for mentally ill patients. These visits are scheduled in the third year as it is the principal outpatient year of training and residents are responsible to provide a comprehensive treatment plan for their patients by following the biopsychosocial treatment approach. These mental health service organizations pertain to giving mental health patients a richly enmeshed network of "wrap around" services so that their social milieu is shaped to have the best outcome.

These monthly educational tours range in duration from 1 to 2 hours under faculty supervision. During scheduled tours, the facility staff usually presented information about their facility and type of services offered. Residents asked questions about the facility, the type of services provided, funding sources for the facility, requirement for medical insurance coverage for their members, their plan in case of emergency, the type of staff available on-site, any fee involved, any job opportunities/placement help available for their members, how to refer patients for their facility, and whether any rehabilitation services are provided, including short stay. The community sites varied in terms of the diversity of the services offered as well as the nature of the clients they serve. Examples of sites included: vocational rehabilitation places for people with physical and mental disabilities, social clubs for people with severe and persistent mental illness, mental health clinics located in jails, local mental health associations, inpatient drug and alcohol rehabilitation service providers, and nonprofit organizations for children with special needs. Tours were in addition to the actual clinical rotations that residents complete at a local community mental health center (CMHC), one day/week throughout their third year of training.

The present study examined the need for visits to social and vocational programs as part of general psychiatry residency training. Programs were asked to share their reasons for providing or not providing such educational tours. This particular array of the "community" aspect of psychiatry training was studied for several reasons. To our knowledge, such a study has not been conducted previously. We wanted to assess other programs' viewpoints regarding our self-constructed approach to target the lacuna of training in community services. Finally, we sought to assess the outcomes from programs including such tours.

Methods

Prior approval was obtained from the Institutional Review Board (IRB) at the University of Kansas School of Medicine-Wichita (KUSM-W).

Participants. All general psychiatry residency program directors who were listed on the FREIDA database on the American Medical Association website were emailed directly from SurveyMonkey® to complete an assessment (n = 175). Each e-mail contained an embedded link to the anonymous survey.

Survey. A brief, five-question survey was designed to assess residents' exposure to community mental health services via visits or educational tours of community mental health service organizations in their area (Table 1). Program directors were asked to indicate if their residency program had a requirement for residents to visit or participate in educational tours. The programs which reported having this requirement were asked to discuss the outcomes of including visits or tours in their programs. The other residency directors were asked about their reasons for not having such a requirement.

Table 1. Survey questions.

1. Does your psychiatric residency program include a component that requires residents to visit or go for educational tours to community mental health service organizations or mental health-oriented social/vocational training programs?
2. What positive outcomes have you seen from exposing your residents to area mental health service organizations or social/vocational training programs?
3. Would you like to include such visits or education tours in your program?
4. Why not?
5. What has kept you from including educational tours to area mental health service organizations?

Data analysis. Survey data were downloaded from SurveyMonkey® into Microsoft Excel before being imported into Statistical Packages for the Social Sciences (SPSS) Version 15 (SPSS Inc., Chicago, IL) for analysis. Univariate analyses were conducted on the quantitative data, with frequencies tabulated to describe responses. Pattern coding was utilized to characterize qualitative responses. This analysis option was utilized due to its ability to pull large amounts of content together into more meaningful and parsimonious units of analysis.

Qualitative responses to the items were reviewed to identify the most prevalent pattern or themes among responses, and then coded and sorted. Research team members independently viewed the qualitative and quantitative results. These separate results were compared in conference among researchers so that final recommendations for coding could be made.

Results

Of the 175 surveys distributed, seven were returned due to invalid email addresses, resulting in a final pool of 168 potential respondents. Of these, 44% (n = 73) responded to the survey. Fifty-six respondents (77%) reported that their residency program included a component that requires residents to visit or participate in educational tours of community mental health service organizations or mental health oriented social/vocational training programs. Seventeen respondents (23%) reported their psychiatric residency programs did not include such a component requiring residents to visit or go on educational tours. Eleven programs (65%) without such requirements indicated a desire to include such a requirement in the future.

Of the 56 respondents that reported that their residency program requires visits or offers educational tours, 48 (86%) respondents offered comments about the positive outcomes associated with these visits. Responses were broadly categorized into three thematic categories: a) a better appreciation/awareness for community mental health service organizations in terms of their nature, logistics, operation and services (n = 24); b) an increased interest in community mental health organizations as prospective employers for residents (n = 15); and c) better ability to work with their patients with improved knowledge about area mental health service organizations (n = 5). The remaining responses were categorized as miscellaneous (n = 4) including responses where program directors have confused these tours with their regular community mental health clinic rotations.

Six respondents reported that they would not like to include such visits or educational tours in their program. Five of these respondents reported their reasons for not wanting educational tours. The reasons included that residents already are assigned to community mental health centers (n = 3), few patients take advantage of community resources (n = 1), and a perception of the

local community mental health center being a “disaster” (n = 1).

The 11 programs who did not require residents to visit community mental health service organizations, but would like to do so, reported the barriers that have kept them from adding such a rotation. All reported time constraints as their main reason. The common constraints were organizing and scheduling the tours (n = 5), lack of planning and availability of faculty (n = 3), and lack of program organization and community sponsorship (n = 2).

Discussion

The survey specifically focused on scheduled visits/tours to community mental health service organizations by residents under faculty supervision to acquire knowledge about community resources. The overall response rate of our survey was comparable with the return rate of a similar survey.[4] In fact, the previous survey identified some sites, such as homeless shelters, intellectual and developmental disabilities programs, jails, and halfway houses, as unavailable to residents, even as electives. In contrast, these sites are prime examples of the psychosocial visit sites asked of our survey respondents.

Fifty-six respondents reported that their residency programs required residents to visit or participate in educational tours of community mental health service organizations. However, based on respondent survey comments, a majority had a CMHC rotation where residents see patients rather than educational tours for couple of hours every month to understand their operation, process of referral, and type of patients who can be referred. Since the majority (77%) of respondent programs required their residents to go on such educational tours, it may be possible that some of these programs misunderstood the term "area mental health service organizations" as being equivalent to a CMHC or confused their regular rotations at a CMHC to monthly scheduled tours/visits to different mental health service organizations. If that was the case, the 77% could be an inflated estimate. Thus, the present findings should be considered preliminary and warrant further delineation of the exact meaning of such terms used in any future surveys.

Failing to identify respondents geographically was another limitation of this survey. The survey was intentionally anonymous. Anonymity was preserved to avoid influencing public opinion for any particular program. Also, anonymous surveys were more likely to be completed by program directors.

Another major limitation of our survey was the lack of an operational definition of terms such as "community mental health service organizations" or "mental health-oriented social/vocational training programs". A thorough literature search failed to yield such a clear definition. Widespread confusion regarding what constitutes a community mental health center has been documented on more than one occasion.[7-10] The lack of a sharply defined definition and theoretical matrix was discussed at the 153rd Annual Meeting of the American Psychiatric Association, when Kenneth Thompson, M.D., convened a session to address the future of community psychiatry in the United States.[11] To address this issue, the AACP has embarked on a Community Psychiatry certification initiative.[12,13]

In addition to the lack of a clear concept of "community mental health", there is a well-documented deficiency of a single, well-defined, core curriculum for psychiatry training programs, despite numerous attempts to develop one. As the development of a single universal curriculum may not be practical in light of

local availability of resources, residency programs could benefit from sharing other ways of implementing training. Past research has suggested making curricula available on residency program websites.[6]

Conclusion

This survey was intended to create a "snapshot" of US psychiatry residency programs' views about including educational tours to community mental health service organizations in their residency curricula. Far-reaching conclusions cannot be drawn from the results of this pilot survey. However, the need to explore this aspect of psychiatry training further is evident. One necessary improvement for future surveys includes specific definitions of terms such as "community mental health service organizations", "mental health-oriented social/vocational training programs", and "educational tours". It also may be worthwhile to obtain more detailed information about the amount of time allotted for tours/visits, their locations, and the residents' level of training. Such questions will help to identify nationwide themes, which can be used as building blocks for community psychiatry training.

Community mental health service organizations visits should enhance knowledge of psychiatry residents and indirectly promote better patient care. Information such as obtained from this survey should create discussion to work toward better psychiatric resident training. In our program, consistently positive feedback from the residents has kept educational tours available for several years.

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Pediatric Resident Knowledge, Confidence, and Experience in Transitioning Youth with Special Healthcare Needs

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Abstract

Background. The transition from pediatric to adult healthcare is vital to the 17% of adolescents with special healthcare needs (SHCN). Barriers to successful transition exist. The purpose of this study was to assess the baseline knowledge, confidence, and experience of pediatric residents in our state on transitioning adolescents with SHCN from pediatric to adult-oriented health care.
Methods. An anonymous, voluntary, self-report survey was distributed electronically via Survey Monkey® to 2011-2012 pediatric residents in the state of Kansas (n = 39).
Results. Of 39 pediatric residents, 21 (54%) completed the survey. Most (71%) had two or fewer adolescents with SHCN on their patient panel. Overall, the majority categorized their knowledge (71%) and experience (81%) transitioning adolescents with SHCN as minimal or very minimal.
Conclusions. Pediatric residents report a general lack of knowledge, confidence, and experience in transitioning youth with SHCN. Additional training opportunities are needed to overcome the barriers in successful transition planning.
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Introduction

Over the past two decades, health care providers, researchers, and government agencies have concentrated efforts on improving health care and related services to youth with special health care needs (SHCN). According to the Maternal Child Health Bureau,[1] children with SHCN are those who "have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who require health and related services of a type or amount beyond that required by children generally." This definition is based on the degree of health care utilization rather than disease classification and encompasses children whose conditions vary in severity, including those with and without developmental impairment and physical limitations. These youth are particularly vulnerable in terms of their reliance on uninterrupted medical care for their health and welfare. Thus, addressing gaps in access and quality of care for this population is essential.[2]

Transitions are expected and part of healthy development across the lifespan. The transition from pediatric to adult healthcare is an important milestone for all adolescents, but this process is vital to the 17% of adolescents with SHCN.[3] Transitioning youth with SHCN encompasses a dynamic, patient-centered process that seeks to maximize functioning and potential as youth move from childhood to adulthood.[4]

The purpose of this study was to assess the baseline knowledge, confidence, and experience of pediatric residents in Kansas on transitioning adolescents with SHCN from pediatric to adult-oriented health care.

Methods

An anonymous, voluntary survey was distributed electronically via Survey Monkey® to 2011-2012 pediatric residents

in the state of Kansas (n = 39). Pediatric residencies in Kansas vary in geographic location and resource availability. This was a self-report survey regarding pediatric resident knowledge, confidence, and experiences in transitioning youth with SHCN. For initial nonresponders, two reminders were sent electronically. Prior to distribution, the survey was reviewed by a panel of 15 experts on transition from around the United States. These experts voluntarily reviewed the survey for face validity through an email list serve focused on healthcare transition. The survey also was reviewed by two recent pediatric residency graduates from our institution for clarity.

All data were managed using the Statistical Package for the Social Sciences (SPSS version 17.0; Chicago, IL). The study was approved by the university's institutional review board.

Results

Of 39 pediatric residents, 21 (54%) completed the survey. All were in programs with less than 30 residents. Most pediatric residents (71%) had two or fewer adolescents with SHCN on their patient panel; 43% reported they were uncomfortable providing primary care for youth with SHCN. In addition, the majority categorized their overall knowledge of (71%) and experience (81%) transitioning as minimal or very minimal. No resident rated knowledge or experience above the moderate level.

Familiarity with the process of transitioning varied (see Table 1). Only 14% of residents report attending a training session or lecture on transition. However, for future training, the majority of the group (85%) preferred didactic training sessions to online teaching. One resident stated, "This is a very important topic. I would like to receive more information/education during residency training." Ultimately, 55% responded that they rarely or never discuss the process of transition with families.

Table 1. Resident exposure and experience transitioning youth with SHCN by year.*

	Postgraduate Year		
	1st	2nd	3rd
I have heard about transitioning during my residency.	43% (4/7)	86% (6/7)	86% (6/7)
I have read information about transitioning during my residency.	57% (4/7)	57% (4/7)	60% (3/5)
I have attended a lecture/training session focused on transition.	33% (2/6)	0% (0/7)	20% (1/5)
I am familiar with standardized transitioning resources and tools.	17% (1/6)	0% (0/7)	20% (1/5)
I am familiar with adult health care providers and resources in my community.	33% (2/6)	43% (3/7)	20% (1/5)
I have assisted a patient with transition in my patient panel/ continuity clinic.	67% (2/6)	0% (0/7)	20% (1/5)

*Denominators may vary due to missing responses.

Discussion

The importance of transition planning and support was highlighted in a foundational joint consensus statement released in 2002 by the American Academy of Pediatrics (AAP), American Academy of Family Physicians (AAFP), and the American College of Physicians (ACP).[4] This statement was created to ensure that by

2010 all physicians who provide primary and subspecialty care to youth with SHCN appreciate the need for transition, have knowledge and skills to identify when transitioning support is indicated, and have the ability to facilitate the process. One critical step outlined in this policy advises the incorporation of core transitioning knowledge and skill into resident education and physician certification.

Despite great efforts, in the 2011 clinical report published by the same organizations, authors cited only limited progress has been documented by outcomes research.[5] Lack of physician training and comfort have been cited as major barriers to effective transitioning.[3,6] According to a 2009 survey conducted by the AAP,[3] less than half of pediatricians routinely offer adolescent patients with SHCN support services to transition to adult healthcare. Multiple barriers were cited in the study, including lack of knowledge about community resources for young adults with SHCN (39%), insufficient time for staff to provide transition services (36%), and lack of skills in transition planning (34%).

Currently, there are no known published studies that have looked specifically at pediatric resident knowledge, confidence, or experience in transitioning. However, Patel and O'Hare[7] surveyed pediatric and internal medicine residents to assess their training experiences and comfort treating an array of chronic childhood illnesses in the primary care setting. For children with chronic diseases (including cerebral palsy, Down's syndrome, cystic fibrosis, diabetes, and spina bifida), pediatric residents reported that they were more comfortable with inpatient management versus outpatient (primary care) management of these children.

In our study, residents reported little experience providing ongoing primary care for adolescents with SHCN. This lack of opportunity to follow youth with SHCN in the outpatient environment, combined with barriers of insufficient time and resources cited by pediatricians,[3] may prevent pediatric residents from gaining the skill and confidence needed to successfully transition these youth.

Study limitations included a small population of pediatric residents in Kansas, self-report nature of surveys, and lack of quantitative data to support the findings. A larger, cross section of residents from across the US might yield different results. We recognized that family practice and internal medicine residents also provide care for youth with SHCN and play a role in transitioning. Pediatric residents, however, have a unique role in transitioning and transferring care. Therefore, we focused our study on this population. Inclusion of other providers may have yielded different or additional information.

Conclusions

Pediatric residents in Kansas have a general lack of knowledge, confidence, and experience in transitioning youth with SHCN. Barriers to successful transitioning exist. Additional educational opportunities through didactics and patient care experience are needed in this area. Training on transitioning must be integrated into resident education. Pediatric faculty should use this information when developing pediatric resident curricula.

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Splenic Embolization Decreases Infectious Complications and Resource Utilization Compared to Splenectomy in Severely Injured Patients

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Abstract

Introduction. Increasing use of main coil angioembolization for splenic injury has raised concerns of increased complication rates and resource utilization compared to splenectomy. This study examined complication rates for severely injured patients undergoing splenectomy versus main coil angioembolization.

Methods. Demographic data (age, sex, and race), Injury Severity Score (ISS), and splenic injury grade were collected prospectively on all patients admitted to the intensive care unit with blunt splenic injury treated with splenectomy or main coil angioembolization. Outcome measures (transfusion requirements, mechanical ventilation use and duration, mortality, intensive care unit and hospital length of stay, infection rate, and systemic inflammatory response syndrome or SIRS score) were reviewed daily.

Results. Of 116 patients reviewed, 65 underwent splenectomy and 51 underwent main coil angioembolization. Groups were comparable for age, sex, race, and mechanism of injury. Splenectomized patients had a higher ISS (41 vs 31) and splenic injury grade (3.7 vs 3.2). The main coil angioembolization group had a lower transfusion requirement, hospital length of stay, incidence of mechanical ventilation, nosocomial infection rate, and SIRS score. Overall, mortality and ventilator days were lower but not statistically significant.

Conclusions. Severely injured patients treated with splenectomy had significantly higher infection rates and resource utilization compared to those treated with main coil angioembolization.

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Introduction

Nonoperative management of splenic injury has become the standard of care in hemodynamically stable adult patients with blunt splenic injury.[1-20] Some trauma centers, including our own, use splenic arteriography and embolization of vascular injuries as an adjunct to improve the success rate of splenic injuries managed non-operatively.[1-6,12-19] With the increasing use of main coil angioembolization for splenic injury, concerns have been raised of increased complication rates and resource utilization in comparison to splenectomy.[7,20] However, the use of splenic embolization has been a matter of controversy for some time, where increased infectious risks from splenic artery main coil angioembolization (SA-MCE) versus splenectomy are both promoted as benefits of the procedure and an unnecessary risk.[1,21-24]

In light of conflicting data, many clinicians are uncertain as to the infectious risks and other complications associated with splenic artery SA-MCE. These risks

have been addressed in patients with isolated splenic injury, but not on multi-trauma patients who presumably would be at greater risk of infection. This study examined the complication rates for multi-trauma patients undergoing splenectomy versus main splenic artery embolization regardless of hemodynamic instability.

Methods

Patient selection. Data were collected prospectively for all critically injured patients (i.e., those admitted to the intensive care unit (ICU) or intermediate care unit (IMC)) with a blunt mechanism of injury who underwent splenectomy or splenic embolization between August 2001 and August 2005. Patients who had splenic embolization followed by splenectomy were excluded from evaluation. Demographic data (age, sex, and race), injury severity score (ISS), and splenic injury grade were recorded. The grade of splenic injury was determined by computed tomography (CT) or intraoperative findings using the American Association for the Surgery of Trauma Organ Injury Scale (AAST OIS) grading system.[25]

Splenic arteriography and treatment protocol. Splenic arteriography was performed on all hemodynamically stable patients with high-grade splenic injury (AAST OIS grades 3-5) and low-grade splenic injury (AAST OIS grades 1 and 2) who demonstrated active bleeding or vascular lesions on abdominal CT.[1,2,12-17] Unstable patients, defined as those with SBP $\leq$ 90 or those the trauma attending deemed to be hemodynamically unstable, were taken directly to the operating room.

Splenic artery MCE was performed if there was evidence of pseudoaneurysm, arteriovenous fistula (AVF), or active bleeding confined to the spleen. Additionally, SA-MCE was performed if secondary evidence of vessel injury was observed (i.e., truncation) or at the discretion of the interventional radiologist and attending trauma surgeon if the patient's clinical condition warranted a more aggressive interventional approach. Selective coaxial micro-coil distal splenic artery branch embolization was performed in addition to SA-MCE if active contrast extravasation into the peritoneal cavity was noted. Patients underwent serial hematocrit determination and abdominal examinations every eight hours. When two stable examinations were obtained, patient activity was liberalized and diet begun. Follow-up abdominal CT was performed at 48 to 72 hours to rule out delayed pseudoaneurysm/ infarction with discharge if no other issues were identified. The decision between operative and non-operative management was based solely on hemodynamic stability (SBP $\geq$ 90) and not age, associated injuries, or need for ICU admission.[1,2,12-17]

Outcome data. Outcome data included all-cause mortality, hospital length of stay (H-LOS), ICU length of stay (I-LOS), ventilator days, and development of infection. Infection was defined using the Centers for Disease Control (CDC) criteria where applicable; clinician judgment was applied in all other circumstances.[26] The site and cultured organisms (if any) were recorded for all infections. The number of units of packed red blood cells (PRBCs) was recorded.

Statistical analysis. Analysis was performed using Stata version 8 (StataCorp, TX). Student's t-test and Pearson's chi-squared analysis were used to compare continuous and categorical variables as appropriate. Multiple linear and logistic regression models were used to control for differences in demographic variables.

Results

Demographics. One hundred eighteen patients underwent splenectomy or splenic

artery embolization. To prevent possible confounding, two patients had both procedures and were excluded from analysis, for a total of 116. Sixty-five patients (56%) underwent splenectomy while 51 (44%) had a splenic embolization. On univariate analysis, age, gender, and race were similar between groups, while ISS was significantly higher in the splenectomy group (40.9 vs 31.4, p = 0.0002; Table 1).

Table 1. Comparison of demographic data and injury severity for the splenectomy and splenic embolization patients.

Treatment	Number	Age (Years)	Gender (% Male)	Race (% Non-white)	ISS*
Splenectomy	65 (56%)	42.0 ± 18.8	70.8%	29.2%	40.9 ± 12.2
Embolization	51 (44%)	36.4 ± 18.9	70.6%	23.5%	31.4 ± 14.7

*ISS = Injury Severity Score, p = 0.0002

Grade of splenic injury. The distribution of grades of splenic injury is given in Table 2. The distribution of grades of injury was significantly different between procedure groups, with higher grades found more commonly among patients who had a splenectomy (p = 0.01). Similarly, the mean splenic injury grade was significantly higher for patients who had undergone splenectomy as compared to those undergoing embolization (3.7 ± 1.0 vs 3.2 ± 0.8, respectively; p = 0.002).

Table 2. Comparison of splenic injury grade distribution by procedure.

Treatment	Number	Splenic Injury Grade [% (n)]				
		1	2	3	4	5
Splenectomy	65	3.1% (2)	7.7% (5)	29.3% (19)	38.5% (25)	21.5% (14)
Embolization	51	3.9% (2)	11.8% (6)	52.9% (27)	27.5% (14)	3.9% (2)

Outcomes, complications, and mortality. On univariate analysis, patients undergoing splenectomy had a significantly greater I-LOS and H-LOS than embolized patients (20.4 vs 14.2 days, p = 0.05, and 29.6 vs 15.5 days, p = 0.0002, respectively; Table 3). Similarly, patients requiring splenectomy were significantly more likely to require mechanical ventilation (97% vs 675%, p < 0.002), and there was a nonsignificant trend towards increased ventilator days in patients who had a splenectomy and required mechanical ventilation (p = 0.06; Table 3). Splenectomy patients also were found to have a significantly higher systemic inflammatory response syndrome (SIRS) score (2.7 vs 2.2; p < 0.05).

Using multiple logistic regression analysis to control for age, gender, ISS, and grade of splenic injury, embolized patients were significantly less likely to require mechanical ventilation than splenectomy patients (Odds Ratio (OR) = 0.14, p = 0.028). No difference was found in the

number of ventilator days among those requiring support (p = 0.16). I-LOS was not different between splenectomy and embolization patients (p = 0.13), however, H-LOS was significantly shorter for embolization patients (coefficient = 14.1; p = 0.001; Table 3).

On univariate analysis, mortality was 22% in the splenectomy group as compared to 9.8% in the embolization group, but this was not significant (p = 0.09, Table 3). Results from multiple logistic regression controlling for age, sex, ISS and grade also failed to show a significant mortality difference (p = 0.73).

Transfusions. On univariate analysis, splenectomy patients received significantly more units of PRBCs than embolization patients (8.5 units, Table 3). Using multiple linear regression analysis to control for age, gender, ISS, and grade of splenic injury, embolization patients received fewer units of PRBC than splenectomy patients (p = 0.03).

Infection. Nearly 65% of splenectomy patients developed an infection during hospitalization (n = 42) while 39.2% of embolization patients developed infection (p = 0.0006; Table 3). The unadjusted relative risk of infection was 0.61 for embolization patients as compared to splenectomy patients. Logistic regression analysis controlling for age, gender, ISS and grade of splenic injury yielded an OR of 0.35 for infection in embolization patients (p = 0.022).

To determine if this effect was due to the higher transfusion requirement and/or greater incidence of hypotension in the group undergoing splenectomy, or related purely to the treatment technique of embolization and splenic conservation, data were reexamined using linear regression controlling for these variables. Initial hypotension had no effect on outcome variables. When controlled for transfusion requirements, however, only reduced H-LOS for MCE remained statistically significant (p < 0.05).

Table 3. Comparison of outcome variables for patients undergoing splenectomy (SPL) vs. main coil embolization (MCE).

Treatment	I-LOS	H-LOS	Vent %	Vent days	PRBC	NOS Infect	SIRS	Mortality
SPL	20.4	29.6 days	97%	22 days	14.5 u	64.6%	2.7	22.0%
MCE	14.2	15.5 days	67%	15 days	6.0 u	39.2%	2.2	9.8%
P value	0.05	0.0002	<0.001	0.06	0.03	0.0006	<0.05	0.09

I-LOS = ICU length of stay, H-LOS = hospital length of stay, Vent % = percent requiring mechanical ventilation, Vent days = days on mechanical ventilation, PRBC = packed blood cell transfusion requirements, NOS Infect = percent with Nosocomial Infection, SIRS = systemic inflammatory response syndrome.

The most commonly cultured organism in embolization patients was Staphylococcus aureus; the most common organism in splenectomy patients was Pseudomonas aeruginosa. Splenectomy patients developed significantly more abdominal, respiratory, bloodstream, and urinary tract infections than embolization patients (Figure 1), however, the overall distribution of infection sites was approximately similar between the two groups. Only seven infections involved encapsulated bacteria; three S. pneumoniae (one SA-MCE, two splenectomy) and four H. influenzae (two SA-MCE, two

splenectomy). There was one S. pneumoniae intra-abdominal abscess in the splenectomy group with the remainder being respiratory in origin, with no mortality directly attributed to any of these infections.

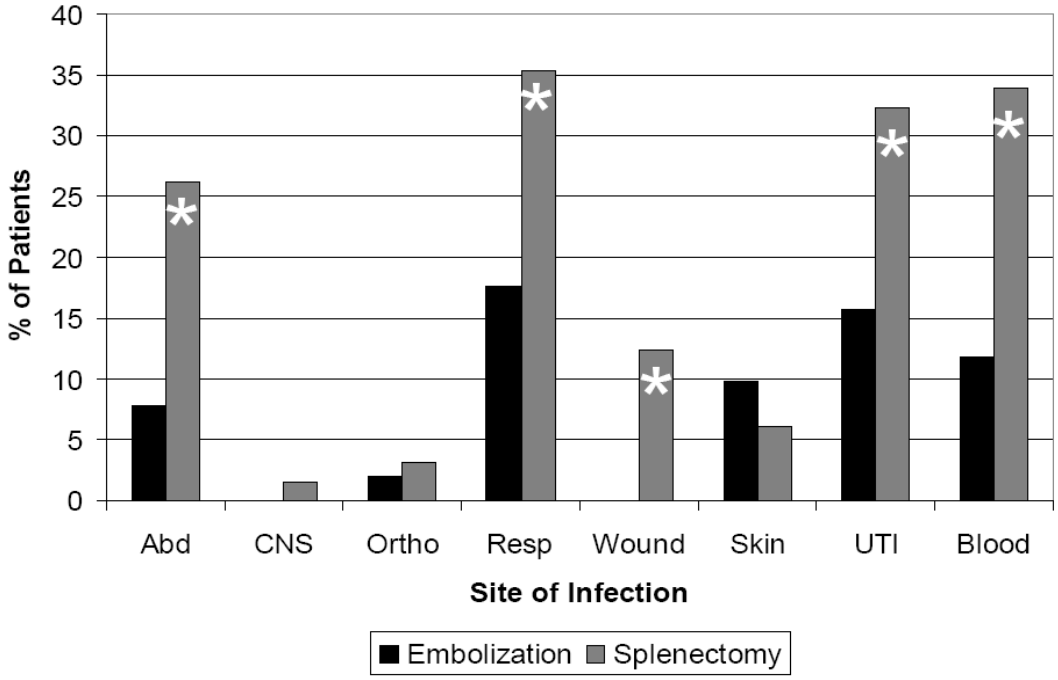

Figure 1. Percentage of patients developing infection at a given site.

Discussion

There remains some debate regarding the utility of splenic angioembolization. A few authors feel that there is no improvement to the rate of splenic gland preservation from angioembolization.[7,20] A larger group has voiced concerns regarding post-procedure complication rates, patient outcomes, and the unknown immunologic effects stemming from splenic embolization.[1-20] Prior studies have documented the complication rates of angio-embolization and our study documented low procedural complication rates, even in the most severely injured patients.[1-6,12-19] There were significantly improved outcomes regarding H-LOS, need for mechanical ventilation, need for transfusion, and mortality.

A limitation of this study was that the splenectomy group was comprised of unstable patients while embolization patients were stable. Although hypotension had no effect on outcome, those patients with increased transfusions requirements had worse outcomes regardless of treatment arm. The transfusions seemed to lead to increased duration of mechanical ventilation, hospital stay, and mortality. This was not surprising as infections and acute respiratory distress syndrome (ARDS) are known to be related to patient transfusion. Numerous researchers have demonstrated similar relationships between blood transfusions and the prolongation of H-LOS, the development of multisystem organ failure, or the incidence of either infection or mortality.[27-30]

In a prospective study, 102 consecutive patients with severe trauma that required blood transfusion were followed.[31] Acute exposure to transfused blood led to a higher rate of ARDS with 21% of patients who received 0 to 5 units of PRBCs, 31% of those patients who received 6 to 10 units of PRBCs, and 57% of those who received greater than 10 units of PRBCs developing ARDS ($p < 0.007$). The association between the amount of transfused blood and the development of ARDS remained significant in their multivariable logistic regression model. This demonstrated the amount of transfused blood is associated independently with both the development of ARDS and hospital mortality. The age of blood also impacted the SIRS response,[32,33] and as a tertiary center older blood generally is received for use. Therefore, the improved outcomes of SA-MCE patients in this study may be related directly to decreased transfusion requirements associated with SA-MCE or, more likely, a selection bias of the more stable patients with lower preexisting blood loss undergoing SA-MCE.

The immunologic effects of splenic embolization remain poorly defined. Pirasteh and coworkers demonstrated encouraging results regarding splenic function based on absence of Howell-Jolly bodies on peripheral smear and normal uptake on technetium-99 scan.[34] Bessoud et al.[19] demonstrated normal exposure driven immunity, streptococcal vaccine response, and splenic Doppler flow in the majority of patients following main coil embolization. This was limited to twenty-four patients evaluated with Doppler and exposure titers. Only six patients underwent immunization with one failure in a patient with chronic lymphocytic leukemia. None of the prior studies focused on clinical evidence of infection. Our study was focused on the most severely injured patients, all of which required ICU or IMC admission. The theory was that this cohort had the highest infection risks and rates. If there were some elements of early immunosuppression related to embolization, this cohort would be more likely to demonstrate this with a higher infection rate than the patients with isolated splenic injury. The fact that the infection and resource utilization rate were lower for the embolization cohort at a minimum was reassuring.

In conclusion, splenic embolization remains a valuable adjunct in splenic salvage. Severely injured patients treated with splenectomy had significantly higher infection rates and resource utilization rates when compared to those treated with main coil embolization. The major correlation with negative results was patient transfusion requirements.

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Keywords: spleen/injuries, splenectomy, therapeutic embolization, infection/complications

Adrenal Hemorrhage Complicated by Hypertension

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Introduction

Adrenal hemorrhage is a rare entity leading to adrenal insufficiency in adults.[1,2] Adrenal hemorrhage is described in patients on heparin therapy, with sepsis and shock, and in association with circulating lupus anticoagulant, surgical stress, orthotropic liver transplantation, and adrenocorticotropic hormone administration.[2,3] Its non-specific presenting symptoms (abdominal pain, fever, tachycardia, hypotension, lethargy, and electrolyte disturbances) lead to it being a frequently missed diagnosis.[1,2]

Before computed tomography (CT), diagnosis usually was made by autopsy.[3] Patients frequently are found to have adrenal hemorrhage by CT scan usually performed for other reasons.[4] Our patient with bilateral adrenal hemorrhage presented with abdominal pain and associated acute reversible hypertension.

Case Report

A 66-year-old Caucasian female known to have dyslipidemia, hypertension, primary hypothyroidism, and osteoarthritis of the hip presented to an outside emergency department complaining of persistent, dull, epigastric abdominal pain that started suddenly several hours prior. The pain radiated to the flanks. There was associated nausea. The patient denied alcohol or illicit drug use. Her family history was negative for bleeding, clotting disorders, and endocrinopathies. Her medications were limited to thyroid replacements and antihypertensives.

The patient underwent total right hip arthroplasty eight days prior to presentation, with an unremarkable intra- and post-operative course. Specifically, no hypertension was noted intra-operatively. Warfarin was prescribed for deep venous thrombosis prophylaxis postoperatively, and the patient reported having been compliant with the medication. Her international normalized ratio (INR) on presentation was 2.2.

Vital signs upon transfer revealed a blood pressure of 189/87 mmHg with a heart rate of 85 beats per minute. She was afebrile. She was in moderate to severe distress due to her abdominal pain. Diminished bowel sounds and diffuse abdominal tenderness were noted.

Laboratory analysis is summarized in Table 1. A serum cortisol level the morning following admission was 6 ug/dL (7-18 ug/dL) with a simultaneously drawn adrenocorticotropic hormone (ACTH) level of 660 pg/ml. The serum cortisol was 2 ug/dL, one hour following 250 mcg cosyntropin. The plasma free metanephrine level was within normal limits, but the plasma free normetanephrine level was elevated at 1.15 nmol/l. CT of the abdomen and pelvis revealed bilateral adrenal masses

Table 1. Serum lab values (reference range).

Lab	Value
Sodium	135 meq/l (136-144 meq/l)
Potassium	3.2 meq/l (3.6-5.1 meq/l)
White Blood Cell Count	12.2 cells/cm^3 (4.8-10.8 cells/cm$^{3)}$
Hemoglobin	11.4 g/dl (12.0-16.0 g/dl)
INR	2.2 (0.9-1.2)
Thyroid-Stimulating Hormone Level	6.94 uIU/mL (0.35-5.50 uIU/mL)
Free Thyroxine (Free T4)	0.8 ng/dL (0.6-1.1 ng/dL)
AM Cortisol Level	6 ug/dL (7-18 ug/dL)
Adrenocorticotropic Hormone Level	660 pg/ml (10-60 pg/mL)
Plasma Free Normetanephrine Level	1.15 nmol/l (<0.90 nmol/l)
Free Metanephrine Level	<0.20 nmol/L (<0.50 nmol/L)
Antiphospholipid Antibodies	Nondetected

consistent with hemorrhage measuring 3.5 x 2.6 cm on the right and 2.8 x 2.7 cm on the left (Figure 1). The remaining adrenal tissue was poorly visualized, but no other anatomic abnormalities were noted. No prior CT scans were available for comparison.

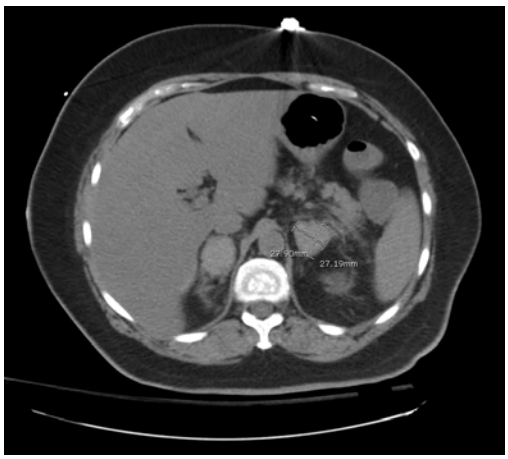

Figure 1. A CT of the abdomen and pelvis with and without contrast revealed a right and left adrenal hemorrhage (see arrows).

Warfarin was held. The patient's blood pressure normalized over the next 72 hours. Because of suspicion that the rise in normetanephrine was strictly secondary to stress from her hypertension, clonidine suppression testing was performed approximately four days after her presentation, resulting in suppression of the normetanephrine level to less than 0.9 nmol/l.

The patient was discharged without anti-hypertensive medications. She was placed on hydrocortisone 50 mg twice daily and fludrocortisone 50 mcg twice daily as adrenal replacement, with a tapering dose as an outpatient. Follow-up CT of the adrenals revealed resolution of hemorrhage without the presence of adrenal neoplasia. The patient was seen for follow-up after six months and adrenal function had not recovered.

Discussion

The adrenal glands play an important role in maintaining blood pressure and electrolytes during periods of physiologic stress.[5] Adrenal hemorrhage has been explained by several mechanisms. One states that during physiologic stress an increase in cytokines (TNF alfa and IL-6) leads to suppression of the hypothalamic pituitary adrenal axis.[4] Furthermore, those inflammatory mediators lead to activation of the coagulation cascade, inhibition of fibrinolysis, and endothelial damage thus leading to adrenal hemorrhage.

Another potential mechanism observes that during physiologic stress ACTH rises,

thus leading to an increase in blood flow to the adrenal glands.[1,4] The adrenal gland is supplied by the three suprarenal arteries that divide into fifty to sixty branches. The capillaries branching from the arteries form a plexus around the zona reticularis.[4] The shift from the arterial system to the capillaries is an abrupt process.[1] The drainage is by a few venules that join to form the central medullary vein.[1,4] This anatomic vasculature structure, also known as the "vascular dam," puts the adrenal gland at an increased risk for hemorrhage.

A high index of suspicion for adrenal hemorrhage is necessary in unexplained abdominal pain or hypotension, as presenting symptoms are vague and routine laboratory studies frequently are not helpful.[5] The most common presenting symptoms and signs for bilateral adrenal hemorrhage (BAH) are hypotension or shock (more than 90 percent), abdominal, flank, back, or lower chest pain (86 percent), fever (66 percent), anorexia, nausea, or vomiting (47 percent), neuropsychiatric symptoms such as confusion or disorientation (42 percent), and abdominal rigidity or rebound tenderness (22 percent).[6] In contrast, our patient presented with hypertensive urgency. The mechanism of this presentation is unknown.

The etiology of this patient's adrenal hemorrhage remains unknown. The differential diagnosis for bilateral adrenal hemorrhage typically includes sepsis (usually secondary to *N. Meningitides*, *P. aeroginosa*, *E. Coli*, and *B. Fragilis)*, antiphospholipid syndrome, heparin-associated thrombocytopenia, warfarin, and severe physiologic stress.[7,8] With the exception of her hypertension, this patient's workup and clinical scenario were highly suggestive of bilateral adrenal hemorrhage secondary to warfarin. The patient was not septic and her platelet count was within normal limits. The timing of her presentation was consistent with other patients who underwent joint replacement surgery and were anticoagulated, with subsequent adrenal crisis as a result of adrenal hemorrhage.[9]

Hemorrhagic pheochromocytoma was noted in 42 cases between 1944 till 2004.[10] Patients usually presented with symptoms of abdominal pain with associated hypertension or hypotension. Usually there was no precipitating event, and most of the cases were identified perioperatively. Our patient's presentation increased the suspicion of hemorrhagic pheochrome-cytoma. Appropriately suppressed free metanephrine and normetanephrine levels, along with a normal follow-up CT scan, make pheochromocytoma less likely, but do not rule it out. It is possible that she had a pheochromocytoma in one or both adrenal glands that was destroyed by the hemorrhage.

Conclusion

The presentation of bilateral adrenal hemorrhage, while classically associated with hypotension, abdominal pain, hyperkalemia, and hyponatremia, is clinically heterogeneous and may include hypertension.

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Keywords: adrenal glands, adrenal insufficiency, hemorrhage, abdominal pain

Blunt Partial Transection of the Innominate Artery: Anomalous Origin of the Left Carotid Artery and Off-Pump Repair

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Introduction

Innominate artery injury occurs, although rare. The innominate artery is the second most common aortic vessel injured as a result of blunt trauma.[1] A blunt mechanism has been associated with up to 35% of innominate artery injuries. Associated innominate artery injuries include aortic or aortic branch injury, pneumothorax, rib fracture, head trauma, and long bone extremity fracture.[2]

Traditionally, surgical correction has been the preferred management option. Surgical options include the use of a graft verses primary repair, a bypass exclusion technique, cardiopulmonary bypass, and profound hypothermia or shunts, especially to maintain or protect cerebral perfusion.[2] Stenting is another treatment option.[3] The use and timing of these interventions depends on the characteristics of the innominate artery injury, associated concomitant injuries, resources of the facility, and comfort level of the surgeon.

The branching pattern of the human aortic arch is varied. These variations should be kept in mind when dealing with great vessel injuries. The term "bovine arch" will not be used to describe the aortic arch branching pattern anomaly found in the current case as a true bovine arch involves a large brachiocephalic trunk that gives rise to both subclavian arteries and a bicarotid trunk.

Two forms of human anomalous arch anatomy have been described as a bovine arch. The first arch variant is characterized as having a common origin of the innominate artery and the left common carotid artery. In a report by Layton and colleagues,[4] they indicated that this variant occurred in approximately 13% of patients. He also reported that the second variant, in which the origin of the left common carotid artery arises from the innominate artery, occurs in less than 10% of the general population. The presence of these anomalies may contribute to the location of a great vessel injury as well as influence the management of the resulting injury in regards to maintaining cerebral perfusion. We report the case of an innominate artery injury in a man with anomalous arch circulation and our management of the injury.

Case Report

A 44-year-old man was transferred from an outside hospital to our American College of Surgeons verified Level 1 Trauma Center, intubated, and hemodynamically stable, after suffering crush injury due to cement and sand from a concrete mixer. Prior to intubation, field examination revealed normal mental status with complaints of back pain. Initial blood pressure and heart

rate in the trauma bay were 178/130 mmHg and 102 bpm, respectively. Following administration of pain medication, the patient's blood pressure and heart rate stabilized to 121/83 mmHg and 83 bpm, respectively. Initial chest radiograph (Figure 1) showed evidence of a widened mediastinum, loss of aorto-pulmonary window and aortic knob, and right-sided pneumothorax, prompting chest tube placement for drainage.

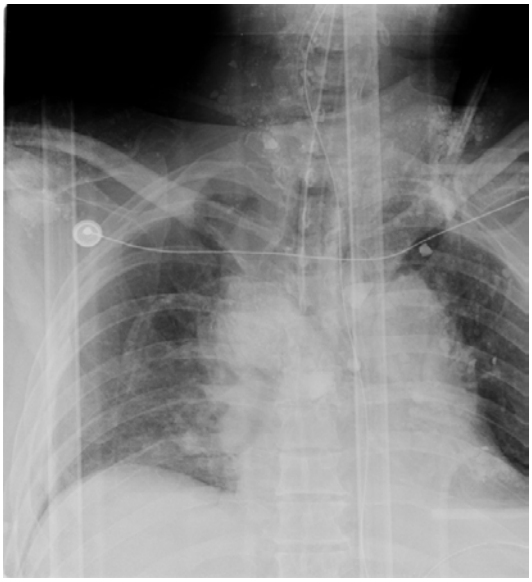

Figure 1. Plain chest radiograph demonstrating a widened mediastinum.

The secondary survey was positive for facial lacerations, open nasal fractures, petechiae on the upper chest, and crepitus on the mid thoracic spine. Upper extremity examination showed equal pulses bilaterally. Computed topographic (CT) examination of the chest revealed mediastinal fullness and a questionable filling defect of the innominate artery distal to an anomalous origin of the left carotid artery (Figures 2 and 3). The CT scan also demonstrated a T6 compression fracture with no retropulsion (10-15% loss of height) and transverse process fractures (T4-8).

Given the T6 compression injury, it remained unclear whether a thoracic vessel injury or congenital web with venous oozing from the T6 compression fracture caused the mediastinal hematoma seen on CT. Angiography was performed for clarification and the radiology report indicated a finding of a focal dissection with associated pseudo-aneurysm involving the innominate artery. Distance between the origin of the aberrant left common carotid artery and the proximal portion of the disruption was 1 cm. There were 2 cm between the distal portion of the disruption and the bifurcation of the innominate artery (Figure 4).

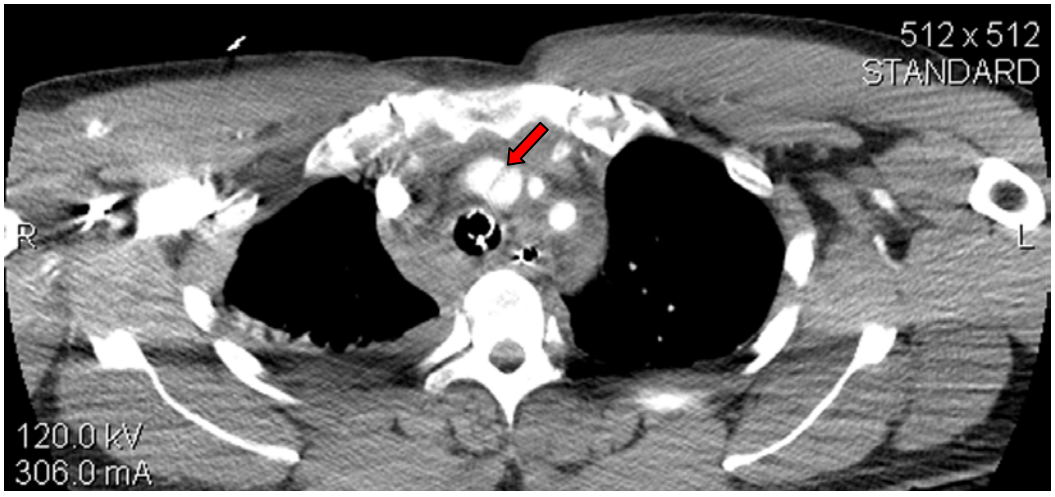

Figure 2. Chest CT scan with contrast demonstrating mediastinal hematoma as well as findings concerning for a dissection or congenital web in the innominate artery (arrow).

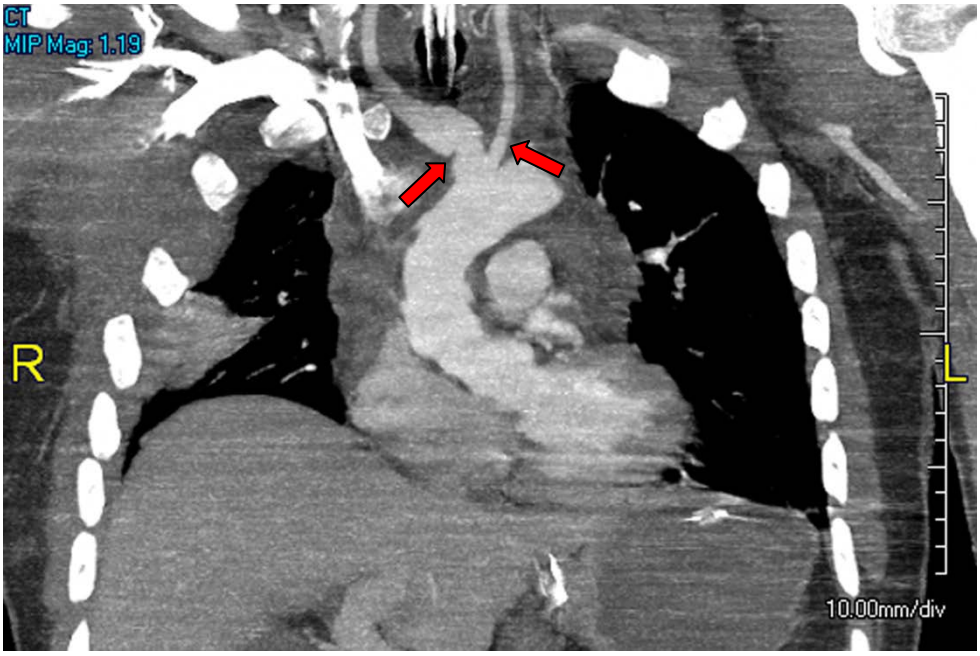

Figure 3. Chest CT scan reconstructions showing an area more suspicious for a focal dissection with an associated pseudoaneurysm versus a congenital web in the innominate artery (left arrow). The anomalous origin of the left carotid artery is also seen (right arrow).

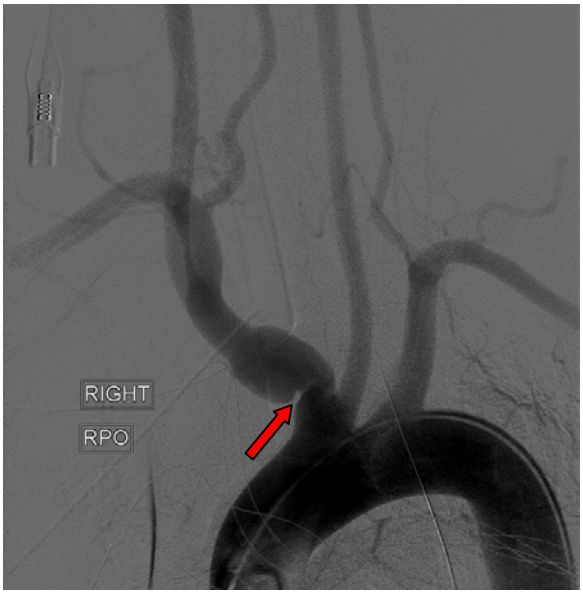

Figure 4. Arteriogram confirming a focal arterial injury (arrow) with pseudoaneurysm in the left innominate artery. The arterial injury is 1 cm distal to the takeoff of the anomalous left common carotid artery and terminates approximately 2 cm proximal to the origin of the right common carotid artery.

Based upon these findings, an off-pump repair with exclusion and bypass of the innominate artery injury was planned. A median sternotomy with extension to the right neck allowed for exploration and delineation of the great vessels. Intra-operatively, significant sternal disruption required complex wire closure at completion. A hematoma was found throughout the fat pad and overlying the innominate artery and anomalous origin of the left carotid artery. The hematoma correlated to the partial transection of the innominate artery. The origin of the left carotid was identified at approximately 1 cm proximal to the partial transection. The area of vascular disruption extended distally to within 2 cm of the bifurcation of the right carotid and subclavian arteries. The innominate vein was preserved.

The patient received heparin (12,000 units) and a side-biting clamp was placed on the ascending aorta. A #10 Hemashield interposition graft (Meadox Medicals, Inc.

Oakland, NJ) was anastomosed to the ascending aorta and the innominate artery distal to the origin of the anomalous left common carotid. Antegrade flow was preserved through the left carotid artery throughout the case.

We evaluated collateral circulation prior to division to ensure cerebral perfusion. The proximal stump of the innominate artery was oversewn with continuous 4-0 polypropylene suture. The free end of the graft was anastomosed end-to-end to the distal innominate artery beyond the injury with continuous 4-0 polypropylene suture. We utilized weave repair of the sternum for closure. After an uneventful postoperative course, the neurologically-intact patient was discharged home after seven days.

Discussion

Blunt injury to the innominate artery is rare. The main etiologies are motor-vehicle crash, crush injury, or fall.[2] The incidence of an anomalous origin of the left common carotid from the innominate artery is between 10-27% of the general population.[1,4-9] Twenty-nine percent of patients who have innominate artery disruption exhibit this anomaly.[1,7] Depending on the incidence of the anomaly in the general population, the percentage of patients who have an innominate artery injury in the setting of the anomaly may be a reflection of its incidence in the general population, or the anomaly may predispose one to an innominate artery injury. In the latter case, the anomalous anatomy of the innominate artery may render it susceptible to injury as a result of the decreased number of fixation points in the aortic arch. When the aortic arch suddenly becomes compressed between the sternum and spine with the neck hyperextended, the energy then is concentrated on the takeoff of the innominate, resulting in a tear or transection.[5]

Eighty-seven percent of innominate artery injuries display a widened mediastinum on chest radiograph.[2] A widened mediastinum, loss of aorto-pulmonary window, loss of aortic knob, or suspicion of a thoracic vascular injury by mechanism should lead to a CT scan of the chest. In the current case, the patient exhibited the first three of these conditions. If a mediastinal hematoma is noted on CT, the patient should undergo an angiogram to rule out injury of the aorta or major branches.[2]

Once an injury to the innominate artery is diagnosed, surgery is the standard treatment, although stenting also has become an option depending on the site of rupture and the operator's experience.[10] In our case, stenting was not an option as a stent repair of the innominate artery would have led to the occlusion of the anomalous left common carotid artery. Timing of the surgery for innominate artery repair is usually urgent, but if the patient has multiple concomitant injuries, repair may be delayed with medical management by maintaining the mean arterial pressure less than 70 mmHg.[3,11-13] A median sternotomy with or without extension along the lower anterior border of the right sternocleidomastoid muscle is the incision of choice. The repair is commonly done by the bypass exclusion technique, without shunting or cardiopulmonary bypass.[3,14-16] Reported long-term patency rates of aorto-innominate artery bypass is high with greater than 96% patency at 10 years.[2,15]

The repair may be performed under profound hypothermia with circulatory arrest[1,17,18] or with cardiopulmonary bypass either with or without selective perfusion of the common carotid artery or retrograde cerebral perfusion,[12,19] with the use of external or internal shunts,[5,8] or by repairing the injury with or without measurement of the carotid artery stump pressure, ideally greater than 50 mmHg.[3] The goal is to

protect cerebral perfusion. Approximately 90% of cerebral blood flow comes from the carotids with the remaining 10% supplied by the vertebrals.[3]

In patients with an anomalous left common carotid artery, cerebral perfusion becomes more complex during clamp repair as the left vertebral artery may provide the only cerebral perfusion after clamping. In our case, initial CT understated the complexity of the injury and angiography was useful for confirmation. The arteriogram also allowed for surgical planning. Secondary to the nature of the patient's anatomy and location of injury, left carotid perfusion was preserved during repair and perfusion to the cerebral vessels were monitored indirectly by intraoperative pressure monitoring from the bilateral upper extremities.

Associated injuries are common with blunt injury to the innominate artery and include other major vascular, thoracic, head, cervical spine, and facial injury, as well as long bone fracture.[2] If cardiopulmonary bypass is required, one also has to keep in mind the risks of full heparinization in patients with head or abdominal injuries. The method of repair also will be individualized based on other associated major vascular injuries that exist in a particular patient.

Conclusion

Successful bypass and exclusion of the pseudo-aneurysm was performed without cerebral compromise and without cardiopulmonary bypass. This was possible due to the lack of any other major vascular injury, lack of brain injury, and the nature of the patient's injury (the innominate artery injury being distal to the anomalous origin of the left carotid artery off the innominate artery). Ultimately, the treatment of a patient with innominate artery injury should be individualized to take into consideration other existing major injuries and location of the lesion. In the face of an anomalous branching pattern of the aortic branches, special consideration should be taken to preserve cerebral perfusion secondary to the anatomic structure where three of the cerebral vessels originate from the first branch point of the aorta.

By identifying the characteristics of the patient's injuries, we achieved a successful repair via bypass and exclusion of a blunt, partially transected innominate artery without cerebral compromise and cardiopulmonary bypass.

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***Keywords*:** blunt injury, trauma, innominate artery, chest injury, common carotid artery

Coronary Artery Disease in a Young Patient Taking Modafinil

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Introduction

Modafinil is a relatively new drug typically used in patients diagnosed with sleep disorders including narcolepsy and obstructive sleep apnea. It has been described as a "stimulant" and can produce cardiac symptoms such as increased blood pressure, asystole, chest pain, and sinus tachycardia.[1,2] There is relatively little data on the correlation between modafinil use and risk for coronary artery disease.

Case Report

A 37-year-old white male with a history of narcolepsy (on modafinil) and post-traumatic stress disorder (on lamotrigine, sertraline, and temazepam) presented with a chief complaint of chest pain. Aspirin therapy was initiated immediately.

Cardiac and lung exams were unremarkable with clear breath sounds and no murmurs, rubs, or gallops. Initial complete blood count (CBC) showed a slightly elevated white blood cell count at 13,700 x 10E3/uL, which was attributed to stress reaction. B-type natriuretic peptide (BNP), thyroid stimulating hormone (TSH) and electrolytes were within normal limits. Initial troponin I was unremarkable and electrocardiogram (EKG) did not show any ST-segment elevation or any other changes when compared to previous EKG.

Approximately eight hours after presentation, blood pressure reached 197/128 mmHg and troponin I increased to 9 ng/ml then peaked at 15 ng/ml. A diagnosis of non-ST elevation myocardial infarction (NSTEMI) was made. The patient was taken for cardiac catheterization, which revealed a 90% occlusion of the left anterior descending artery at the trifurcation of the first major septal artery. A bare metal stent was placed and the patient's chest pain resolved.

Aspirin was continued and a beta-blocker, statin, and clopidogrel were started after the procedure per acute coronary syndrome (ACS) protocol. The patient remained stable and was discharged the following day and was advised not to take modafinil.

Discussion

Modafinil is the first new psycho-stimulant medication for narcolepsy in 20 years. It has become popular recently due to its lower abuse potential and is used frequently in the military for soldiers experiencing excessive fatigue. Although the exact mechanism of action is poorly understood, it most likely acts as an agonist on the central alpha-1 adrenergic system or dopamine system producing stimulation-like effects on the central nervous system (CNS) and vasospasm and tachycardia.[2,3]

Potential cardiac side effects include palpitations, chest pain, ischemic EkG changes, and dyspnea.[1,2] There is a limited amount of literature linking the use of modafinil to coronary artery disease (CAD). However, there is a fair amount of evidence

that modafinil should be used with caution in patients with pre-existing heart conditions such as left ventricular hypertrophy and a history of myocardial infarction.[4]

The prevalence of CAD in younger patients is difficult to establish because it is typically a silent process. In an autopsy study[6] involving 760 patients aged 15 to 34 who were victims of accidents, suicides, and homicides, advanced coronary atheromata were seen in two percent of men aged 15 to 19, but no women. An advanced lesion was present in 20 and 8 percent of men and women aged 30 to 34, respectively, while 19 and 8 percent, respectively, had a 40 percent or greater stenosis of the left anterior descending artery.[7]

There are limited data on the frequency of myocardial infarction in younger, healthier patients with few to no risk factors. One study showed that, although serum lipids have a great role in ischemic heart disease, half of patients with acute myocardial infarction had normal lipid profile.[8,9] Lastly, a study on known cases of ischemic heart disease did not show a combination of risk factors such as hyperlipidemia, hypertension, diabetes, and smoking. Fifteen percent of men, 19% of women, and more than half of all patients had only one classic risk factor.[10,11]

Conversely, our patient was a young, non-diabetic, healthy male with no family history of CAD. He did not have hypercholesterolemia or metabolic syndrome, did not smoke, use cocaine, or other illicit drugs, and should not have been at risk for myocardial infarction. However, he was taking modafinil for narcolepsy for approximately 20 months and we believe this drug could have contributed directly to his in-hospital hypertension, CAD, and ultimate myocardial infarction. Another consideration was that modafinil indirectly caused his CAD as a result of his in-hospital hypertension. For these reasons, modafinil was discontinued upon admission and after discharge for secondary prevention.

Conclusion

Our patient was young and had minimal risk factors predisposing him to CAD. It is unclear whether the patient's long-term use of modafinil contributed to his course and need for intervention. Further prospective and/or retrospective studies of patients with long-term usage of modafinil may be beneficial to define the advantages and disadvantages of this drug better. Also, further genetic studies may help our understanding of why certain exposures correlate more strongly with CAD in some patients compared to others. Our case demonstrated that modafinil may play a role in the CAD spectrum and that clinicians should keep this in mind when prescribing this drug.

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Keywords: chest pain, coronary artery disease, narcolepsy, modafinil

Blastic Plasmacytoid Dendritic Cell Neoplasm

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Introduction

Blastic plasmacytoid dendritic cell neoplasm (BPDCN) is a rare, highly aggressive hematopoietic malignancy.[1] It manifests as cutaneous and bone marrow involvement and leukemic spread. It represents 0.7% of primary cutaneous lymphomas. Recently, it was established as a distinct entity.[2] We present a rare case of BPDCN with good response to chemotherapy and review the clinicopathologic features of this disease.

Case Report

A 67-year-old man was admitted to the hospital because of a 6-month history of fatigue, weight loss, and cough. On physical examination, he manifested hepatosplenomegaly with multiple palpable bilateral axillary and inguinal lymph nodes. Cell count and basic metabolic profile were within normal ranges. Computed tomography (CT) scan of the chest, abdomen, and pelvis demonstrated multiple axillary, mediastinal, intra- and retro-peritoneal centimetric and infracentimetric lymph nodes, splenomegaly (21 cm), and hepatomegaly (21 cm).

Histopathological examination of the right axillary lymph node biopsy specimen revealed atypical interfollicular and medullary infiltrate composed of monotonous monomorphous population of small to medium cells with round and oval nuclei, finely dispersed chromatin, small nucleoli, and scant cytoplasm admixed with scattered transformed lymphocytes and histiocytes. Immunohistochemical staining, performed on formalin fixed, paraffin-embedded tissue, showed a strong expression of CD5 in the tumor cells. CD10 was slightly positive. The CD3 showed many small CD3 positive T-cells predominantly surrounding the intact follicles, and scattered within the inter-follicular and medullary infiltrates. The CD34 was negative in the infiltrates and positive in the vasculature. TdT showed rare, scattered weakly positive cells within the infiltrates. The CD7, CD123 and TCL-1 were positive on numerous cells within the infiltrate. Other stains (CD20, CD38, CD57, PAX-5) were negative. Ki-67 stained approximately 30% of the tumor nuclei.

Bone marrow studies showed an interstitial infiltrate composed of small to intermediate sized atypical immature cells with round and oval nuclei, dispersed chromatin, and indistinct nucleoli. Immunohistochemical studies were performed. CD4 and CD56 showed no tissue staining likely secondary to tissue process/technical issues. CD5 showed scattered small CD5 positive T-cells throughout the bone marrow interstitium. CD123 and TLC-1 stains were similar in appearance and highlighted a predominantly interstitial infiltrate that represented approximately 10-20% of the total bone marrow cellularity.

The patient was diagnosed with BPDCN

based on his clinical and histopathological findings. He received four cycles of cyclophosphamide, hydroxydaunorubicin, vincristine, and prednisone (CHOP).

Repeated CT, four months later, showed a decrease in mediastinal adenopathies and spleen size. Also, a bone marrow study showed less than 3% of expressing plasma cells. The patient was scheduled for a total of four additional cycles of CHOP with follow-up imaging.

Discussion

BPDCN was described in 2008 and classified as an acute myeloid leukemia and related precursor neoplasms.[2] In 2001, the World Health Organization (WHO) classified it as "blastic natural killer cell lymphoma".[3] In 2005, it was termed $CD4^+/CD56^+$ hematodermic neoplasm in the WHO-European Organization for Research and Treatment of Cancer classification.[4]

BPDCN affects primarily the elderly and has an aggressive clinical course with a poor prognosis.[5-7] Ninety percent of cases presented with asymptomatic solitary/multifocal cutaneous reddish-brown nodules or bruise-like lesions.[5,6] Bone marrow was involved in most cases, however, any organ, can be affected. Extramedullary leukemic infiltration may precede acute myeloid leukemia. The disease follows a short course and fulminant leukemia is the common terminal stage.

Histopathologically, the neoplastic cells are characterized by monotonous non-epidermotropic infiltration of uniform medium-sized cells with round nuclei and finely dispersed chromatin and absent or indistinct nucleoli, resembling lymphoblast or myeloblasts.[8,9] The cytoplasm is scant, difficult to visualize, and never exhibits granulation. The typical monomorphous, blastic neoplastic cell morphology is evident in only 44.4% of cases.

Diagnosis is made by the immunophenotypic features of the malignant cells. However, cytogenetic analysis is not helpful since no recurrent specific chromosomal aberrations were recognized.[10,11] Flow cytometry is preferred over immunohistochemical analysis as it allows for the examination of more markers and their intensity determination. BPDCN is defined by the expression of CD4, CD56, and CD123 in the absence of T-cell, B-cell, or myeloid markers.[5-11] The Ki-67 labeling index of BPDCN reportedly ranges from 20% to 90%.[8] However, the neoplastic cells of BPDCN show a greater variability of morphologic and immunophenotypic features.[8,9] Ascani et al.[12] and Aragrakos et al.[13] reported a CD4-negative variant of BPDCN. Cases of CD56-negative and CD123 negative BPDCN also have been reported.[8]

The prognosis of BPDCN is poor, with a median survival period of 14 months, and with two- and five-year overall survival rates of 33% and 6%, respectively.[14] There is no consensus on the optimal treatment for BPDCN. The therapeutic approaches described in the literature are very different and not standardized. Initially, most patients show a good response to treatment, but relapse quickly.[15] Long-term remissions rarely have been reported in younger patients who received acute leukemia-type induction therapy and allogeneic stem cell transplantation.[9,16]

Conclusion

BPDCN should be considered in the differential diagnosis of hematopoietic tumors, especially due to the diversity of cell morphology. Accurate diagnosis requires careful histologic examination and appropriate immunohistochemical and flow cytometry panels, including CD4, CD56, TCL1, and CD123. This variant should be recognized to make an early diagnosis. Once diagnosed, patients can be managed properly.

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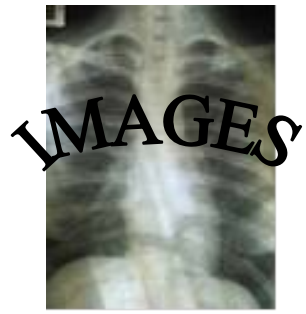
Keywords: lymphoma, leukemia, immunophenotyping, CD123 antigens, Ki-67 antigen



Emphysematous Pyelonephritis: Not an Everyday Diagnosis!

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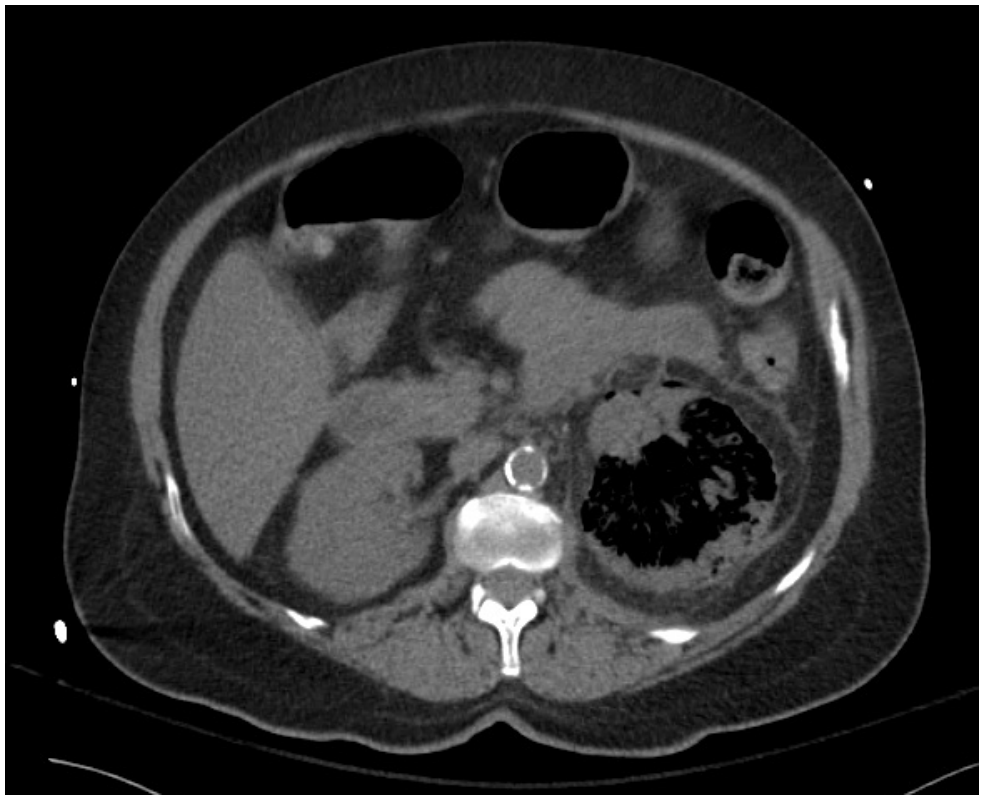

A 52-year-old female known to have uncontrolled type 2 diabetes mellitus (hemoglobinated A1c level of 11.2%) and history of recurrent urinary tract infections was admitted with diabetic ketoacidosis and sepsis presumably secondary to a urinary infection. Physical examination was noteworthy for left flank tenderness. Computed tomography of the abdomen and pelvis revealed diffuse air throughout the parenchyma within Gerota's fascia consistent with emphysematous pyelonephritis (see image). The patient was started on broad-spectrum antibiotics and underwent left nephrectomy. Post-operatively, she required pressor agents for septic shock. A urine culture grew ceftriaxone-sensitive *Escherichia coli*. She was discharged to finish a 14-day course of intravenous antibiotics which she tolerated well with no other complications.

Discussion

Emphysematous pyelonephritis (EP) is an acute necrotizing infection complicated by gas formation within the renal parenchyma.[1] Four factors lead to risk for EP: high blood glucose, poor tissue perfusion, the presence of gas forming bacteria, and immunosuppression. *E. coli* is the pathogen in most cases. However, EP also has been described in association with infections by *Klebsiella*, *Proteus*, *Streptococcus*, and *Candida* species. The diagnosis usually is made radiologically with computed tomography being the modality of choice. EP is associated with high rates of morbidity and mortality.[2] Management is based on radiological classification and risk factors and ranges from conservative management (antibiotics and percutaneous drainage) to nephrectomy.

Physicians should consider the diagnosis of emphysematous pyelonephritis in the setting of diabetic ketoacidosis and abdominal pain.

References

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[2] Sharma PK, Sharma R, Vijay MK, Tiwari P, Goel A, Kundu AK. Emphysematous pyelonephritis: Our experience with conservative management in 14 cases. Urol Ann 2013; 5 (3):157-162. PMID: 24049377.

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