Treatment of Snakebites at a Regional Burn Center: Report of a Case Series

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Abstract

Background. Although uncommon, snakebites can cause significant morbidity and mortality. The objective of this study was to review the characteristics, treatment, and outcome of patients with a suspected or known snakebite who were treated at a regional verified burn center.

Methods. A retrospective chart review of all snakebite victims was conducted for the time frame between January 1991 and June 2009.

Results. During the study period, 12 patients were identified. One of the twelve patients was excluded because he had been admitted as an outpatient for wound debridement after being initially treated at another facility. Ten of the remaining 11 patients were male (90.9%). Rattlesnakes were responsible for the majority of bites. One of the eleven patients needed a fasciotomy. The majority of patients received antivenin (ACP/fabAV). No anaphylactoid reactions to either antivenin were recorded. There were no deaths.

Conclusion. With burn centers evolving into centers for the care of complex wounds, patients with snakebite injuries can be managed safely in a burn center.

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Introduction

Snakebites, although rare, can be life-threatening. Between 5,000 to 7,000 venomous snakebites occur annually in the United States.[1,2] From one to six deaths occur per year in the United States from envenomation.[3-5] Snake venom can cause local tissue damage, neurotoxicity, and non-specific systemic effects. Systemic reactions can lead to disorders in coagulation, acute renal failure, hypovolemic shock, and death.

The purpose of the current study was to review the characteristics and outcomes of all snakebite victims admitted to a regional medical center. The standard practice is to admit these patients to the American Burn Association verified regional burn center with care provided by designated burn and wound care surgeons.

Methods

Study design, setting, and selection of participants. A retrospective chart review was conducted of all patients admitted to a regional health center for the treatment of a snakebite between January 1991 and June 2009.

Data collection and analyses. Patient medical records were reviewed for demographics, location and number of snakebites, type of snakebite, mode of arrival, patient presentation, antivenin treatment, antibiotic treatment, tetanus history, wound care treatment and surgical interventions, complications, and outcomes. Data summaries were calculated using SPSS release 16.0 (IBM Corp., Somers, New York).

This study was approved for implementation by the Institutional Review Board of Via Christi Hospitals Wichita, Inc. and the Human Subjects Committee of the University of Kansas School of Medicine-Wichita.

Results

During the study period, 12 patients meeting stated criteria were identified. However, one of these patients had been admitted as an outpatient for wound debridement and split thickness skin graft after initial treatment at another facility and was excluded from the study outcome measurements. Of the remaining 11 subjects, the majority was male, Caucasian, and their average age was 33.5 years (Table 1). One patient (9.1%) under the age of 18 was identified. Nearly one-half of the patients were transported by air to the facility (45.5%).

Of the 11 patients with snakebites, five were the result of rattlesnake bites (Table 2). Type of snake was unknown in three patients (27.3%), however, in two, rattlesnakes were suspected. If true, then rattlesnakes were responsible for 7 of the 11 envenomations (63.6%). The majority of patients sustained one snakebite (81.8%). Of the 14 bites sustained, the majority were located on the hand (64.3%). Of the two patients that sustained multiple bites, one sustained two bites to the hand and one sustained two bites to the hand and one to the forearm. Therefore, of the 14 bites, 78.6% were located on upper extremities and 21.4% on lower extremities.

Ten patients (90.9%) were bitten between the months of April and September. Two of the patients (18.2%) were owners of the snakes that bit them. Four envenomations (28.6%) involved intentional interaction with the snake, and nine envenomations (81.8%) occurred while the patient was outside. The action was uncertain in one patient's case, but the bite was from a pet copperhead snake. Three patients (27.3%) had consumed alcohol prior to being bitten.

Pre-hospital treatment was documented for four patients (36.4%). Two were self-treatments and the remaining treatments by EMS. Of the two self-treated cases, one patient used his belt as a tourniquet and another attempted to "suck" the venom from her thumb. Of the two cases treated by EMS, both had some form of a tourniquet applied, and one had ice packs placed over the wound.

Nine patients (81.8%) received antivenin (Table 3), of which six received ovine polyvalent Crotalidae antivenom (FabAV) and two received equine antivenin Crotalidae polyvalent (ACP). In one patient, the type of antivenin administered was not documented clearly. Of the patients receiving FabAV, an average of 10 ± 6 vials was given. For patients receiving ACP, one was administered 6 vials, and the other 20 vials. Of the two patients who did not receive antivenin treatment, one case was at the request of the patient's family. The other patient who did not receive antivenin had a local reaction to a test dose of equine ACP and was not given the antivenin. No anaphylactic reactions to the antivenins were recorded.

All patients had their tetanus status checked and were updated as indicated by standard guidelines. Five of the 11 patients (45.5%) were given prophylactic antibiotics during their treatment course (Table 3). Of the six patients who did not receive antibiotics, one returned for an incision and drainage for an abscess, and subsequently was prescribed antibiotics.

A teen male bitten just above the Achilles tendon required a fasciotomy for clinically diagnosed compartment syndrome. Three complications were noted including one patient with compartment syndrome and another with a bite infection. The final patient was readmitted, after leaving against medical advice, with a gastrointestinal (GI) bleed, secondary to suspected disseminated intravascular coagulation several days after the snakebite injury.

Table 1. Patient demographics and transport mechanism.

Parameter	Number	Percent
Number of subjects	11	100%
Mean age, years	11	33.5 ± 10.9 (12 – 45)*
Male sex	10	90.9%
Race		
Caucasian	8	72.7%
Hispanic	2	18.2%
Unknown	1	9.1%
Transport method		
Air	5	45.5%
Private vehicle	3	27.3%
Ground Emergency Medical Services (EMS)	3	27.3%

*Mean ± standard deviation (range)

Table 2. Snake bite characteristics.

Parameter	Number	Percent
Type of snake involved		
Rattlesnake	5	45.5%
Copperhead	3	27.3%
Unknown	3	27.3%
Number of snake bites		
1	9	81.8%
2	1	9.1%
3	1	9.1%
Location of snake bites		
Hand	9	64.3%
Forearm	2	14.3%
Lower leg	2	14.3%
Foot	1	7.1%

Table 3. Treatments administered hospitalization characteristics and mortality.

Parameter	Number	Percent
Antivenin administered	9	81.8%
Antibiotics administered	5	45.5%
Infection	1	9.1%
Surgical intervention	2	18.2%
Burn center admission	10	90.9%
Required mechanical ventilation	1	9.1%
Burn Center length of stay, days	10	3.5 ± 2.7
Hospital length of stay, days	11	4.2 ± 2.7
Mortality	0	0.0%

Ten of the 11 patients (90.9%) were admitted to the burn center with an average length of stay of 3.5 days (Table 3). Average hospital stay was 4.2 days. There were no deaths and all patients were discharged to home.

Discussion

General. The findings in this case series are similar to those in other studies. The majority of the snakebite victims in prior reports were also male (66.6-100%).[6-10] One study found most bites (67%) resulted from intentional exposure and 40% of snakebite victims had consumed some amount of alcohol prior to the bite.[11] Mortality from snakebites has been reported between 0-0.21%.[1,2,8,9] The average hospital length of stay for patients in various studies ranged from 2.8 to 5.6 days.[9,12,13] Tokish et al.[12] reported that 36% of patients were transported by air.

The majority of snakebites (84-94%) occurred between the months of April and September.[1,2,12,14] Most injuries, 95-100% of bites, occurred on the extremities.[10,14] Parish[1] reported the majority of bites in the lower extremities (58%).

All of the snakes identified in our study were types of viperids (rattlesnakes and copperheads). No coral snakes (elapids) were identified as the culprit in this study. This finding is most likely geographically related. Crotalidae snakes, the subfamily of viperids that includes the rattlesnakes, copperheads, and cottonmouths, also were found as the most common cause of snakebites from the database of the American Association of Poison Control Centers (98% viperid; 2% elapids).[2]

Prehospital care. Tokish et al.[12] found that 18% of snakebite patients received some sort of first aid prior to presenting to their facility. The methods included "cut and suck", cryotherapy, tourniquet, and superficial constriction band. Cryotherapy lead to extensive soft-tissue necrosis when compared to no treatment.[15] No improvement in survival or outcome with incision and suction has been shown in humans[16] and there is no evidence that lymphatic constriction bands (flat, wide bands applied only to block superficial venous and lymphatic flow, but loose enough to admit 1-2 fingers) provide any treatment benefit. In our series, none of the patients that employed cryotherapy, tourniquet/superficial constriction band, or local wound suction required surgical intervention or had complications, although all of these therapies were discontinued in the emergency department.

Antibiotics. Antibiotic usage in our study (46%) was slightly higher than that reported by Nazim (36%).[10] In our series of patients, antibiotics were administered as prophylaxis, however, wound infections after crotalid envenomation have been reported to occur in approximately 3% of cases, therefore, it is recommended that antibiotics only be given when clinical and microbiologic evidence of wound infection is present.[14,17]

Surgical interventions. Approximately 8 to 28% of snakebite patients require surgical intervention, with the majority requiring fasciotomy (4 to 15.6% of all snakebite patients).[9,10,12,13] Only one of our patients (9%) required a fasciotomy, for elevated compartment pressures. For patients with elevated compartment pressures, Gold et al.[18] recommended an additional 4-6 vials of FabAV over an hour should be administered.

Antivenin. Antivenin Crotalidae Polyvalent (ACP) was introduced in 1954. It is comprised of immunoglobulins isolated from horse serum after exposure to *Crotalus atrox* (Western diamond rattlesnake), *Crotalus adamanteus* (Eastern diamond rattlesnake), *Crotalus durissus terrificus* (Tropical rattlesnake, Cascabel), and

Bothrops atrox ("Fer-de-lance"). It has not been distributed since 2002 and all United States stocks were to have expired as of March 2007.[14,19] Rates for acute allergic reactions (including hypotension and anaphylaxis) ranged from 23-56% for ACP.[17]

FabAV was introduced in 2000.[14] It is purified Fab fragments of sheep immunoglobulin after exposure to *Crotalus atrox* (Western diamondback rattlesnake), *Crotalus adamanteus* (Eastern diamondback rattlesnake), *Crotalus scutulatus* (Mojave rattlesnake), and *Agkistrodon piscivorus* (cottonmouth or water moccasin).[19] The incidence of acute reaction with FabAV have been reported at 14.3%, and nearly all events were mild to moderate.[17] Contraindications to FabAV include a known hypersensitivity to papaya or papin.

Beside the differences in acute allergic reactions, fewer fasciotomies with FabAV (9%) than with ACP (24%) have been documented.[9] Recommended dosing for FabAV are 4-6 vials to achieve initial control, with an additional 4-6 vials until control of symptoms is reached. After initial control is reached, two vials at 6, 12, and 18 hours are recommended to prevent recurrent toxicity.[20] In a review of our patients, the indication and timing of the doses were similar to the previously mentioned strategy. The ovine FabAV has a relatively short half-life of 12-30 hours.

Treatment recommendations. Prehospital treatment should include avoiding excessive activity, immobilizing the bitten extremity, and quickly transporting the victim to the nearest hospital.[17] Initial hospital management includes managing the airway, evaluation of breathing and circulation, providing supportive care, cleaning of the wound, consultation with a medical toxicologist if needed prior to antivenin administration, and providing tetanus toxoid or tetanus immunoglobulin if indicated.[17] Patients with moderate to severe toxicity after Crotalinae bites, or confirmed rattlesnake or water moccasin (cottonmouth) bites and minimal toxicity should receive FabAV.[19]

Patients with confirmed copperhead bites and minimal toxicity should not receive FabAV. Copperhead bites are not considered to be as toxic as cottonmouth or rattlesnake bites.[13,14] A report of 60 patients with copperhead bites treated without antivenin or surgery did not lead to any death, infection, tissue loss, or compartment syndromes.[21]

Patients should be monitored for any acute reactions. Epinephrine, diphenhydramine, cimetidine, inhaled albuterol, and intravenous corticosteroids should be readily available.[17] Patients should be monitored for compartment syndrome and should be confirmed with compartment pressure measurements. Antibiotics are generally not recommended. Patient's laboratory values should be monitored for coagulopathy and rhabdomyolysis.

In some hospitals, all snakebite patients are admitted to an intensive care unit (ICU) for monitoring, regardless of treatment with antivenin, although one case review suggested that the ICU is overused for the treatment of snakebite patients.[12] It is standard policy in this institution for all snakebite patients to be admitted to the burn center, in which all beds are ICU capable. With many burn centers evolving into complex wound centers, patients with snakebite injuries may represent another group that can be provided appropriate care in that setting.[22]

Limitations. This study is subject to the limitations inherent to all retrospective studies: reliance upon data as recorded at the time of patient care, lack of specific details, and possible recording inaccuracies. Another limitation of this study was no standard grading scale for assessment of

envenomation. Additionally, this investigation suffered from a relatively small sample size, limiting the validity of any conclusions drawn from the data.

Conclusions

Guidelines for snakebites, such as used in our institution, may be beneficial as they represent an uncommon injury. The guidelines should include a grading scale for the assessment of envenomation to avoid the unnecessary use of FabAV. With many burn units across the country accepting non-burn patients, including patients with complicated wounds, those with snakebite injuries can be monitored and managed effectively in a burn unit. Furthermore, the presence of burn trauma surgeons can facilitate surgical intervention for compartment syndrome and/or the need for debridement and wound closure.

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Does Informing Referring Practices About Visit Non-Compliance Improve Subsequent Show Rates to a Pediatric Cardiology Practice?

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Abstract

Background. Missed specialty appointments are common. Consequently, patients may never receive intended sub-specialty care. We predicted that no-show (NS) notification would result in more successful encounters following a NS.

Methods. Referring practices were surveyed regarding how NS communication may change patient management. To test the effect of NS notification, two prospective patient groups were evaluated: a non-notification group (Control) and a NS-notification group (Intervention). Patients were tracked seven months to determine rates and time to a successful encounter. Group differences were assessed by either a two sample Z-test for proportions or an independent t-test.

Results. The survey indicated that 43.7% of practices routinely receive NS notification from subspecialists. For 69%, NS notification would prompt patient/family contact. Baseline NS rates for the Control group (n = 633) was 10% (n = 67) and for the Intervention group (n = 623) was 13.5% (n = 83, p = 0.1). Rates of eventual successful encounters among NS patients were 28% for the Control group and 11% for the Intervention group (p = 0.21). Mean time to successful encounter was shorter in the Intervention group (Control, 2.9 months +/-2; Intervention, 1.65 months +/- 0.9, p = 0.045).

Conclusion. Unlike adult studies, pediatric practitioners likely would intervene if a NS was known. Although fewer patients were seen in the NS notification group, the time to encounter was shorter for the Intervention group compared to Controls. While NS notification may not lead to more successful encounters, enhanced communication to the referring practice may ensure that the most worrisome patients are seen promptly.

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Introduction

Missed medical appointments are common. Failure to keep appointments may decrease office productivity and impact patient health.[1,2] Visit non-compliance rates vary ranging from 4-15% in primary care,[3] 31-40% in pediatric subspecialty clinics,[3] and 20-30% for mental health and other adult subspecialties.[4] Although many successfully re-schedule, up to 50% of mental health patients drop completely out of scheduled care.[4] One study tracked nearly 7,000 primary-care patients age 65 or older and discovered that only 50% of those patients received the intended subspecialty care prescribed by their primary physician as a result of missed appointments.[5]

In many practices, it is routine for the subspecialty office to notify primary care offices of a missed office visit out of concern that the missed appointment may otherwise go unrecognized. As a result of this knowledge, one may anticipate that the referring physician would decide (with or without re-contacting the patient) whether the encounter was still appropriate. However, few studies evaluated how missed appointments are perceived and managed by the primary care office. Interestingly, Lloyd

et al.[6] interviewed referring physicians regarding their alleged role in re-contacting adult non-attenders to a psychiatric out-patient clinic. The survey suggested that the majority of respondents did not indicate a perceived responsibility for re-contacting their referred patients. Rather, respondents preferred that referral center reschedule appointments up until such time that they would be discharged because of chronic non-compliance. The authors speculated there was a potential risk for referrals being lost to follow-up and consequently compromising care. To our knowledge, there are no data regarding how pediatric offices manage subspecialty NSs. Thus, we were interested in determining whether pediatric practitioners viewed the responsibility of intervening following a NS differently.

The study goals were twofold. First, a mailed survey to referring centers sought to determine if NS notification was deemed helpful in terms of patient management by the primary practitioner. Second, a prospective cohort study was designed to determine whether NS communication resulted in a greater number of successful subsequent encounters compared to no notification. We speculated that pediatric practitioners would accept an active role in helping children to be seen by the cardiologist as needed if NS information was provided.

Methods

This study was reviewed by the University of Kansas Medical Center Human Subject Committee (IRB) and designated as a quality improvement project. Thus, informed consent was not required for either patients or survey respondents.

Information collected from referring practitioners. Prior to this project, it was not routine to notify referring offices of a NS to cardiology. To assess pediatric practitioners' perspective regarding how NS notification might influence patient management, a survey was mailed to all known actively referring physicians to the University of Kansas Medical Center Pediatric Cardiology clinic during January and February, 2012. A non-validated, quality improvement survey (Appendix) was designed to understand how offices were notified about NS and whether they would act upon this knowledge. The survey also addressed the controversial issue of cancelling referrals in the face of chronic non-attendance. The survey was sent prior to NS data collection and included:

- whether referral centers routinely notify the office of a NS;
- the preferred method to be informed of a NS;
- what action might be taken if there was a NS notification;
- what would influence the decision to contact a family regarding the NS;
- who would be most influential to keep an appointment; and
- should referrals be cancelled after more than three NSs.

Subjects. For study purposes, a missed appointment was defined as a non-cancellation either the day before a morning clinic or within a half-day notice of an afternoon clinic (clinical policy). All patients referred to University of Kansas Pediatric Cardiology (0-18 years of age) over two four-month blocks of time (2/12-10/12), whether new or established, or seen at either the University of Kansas based practice or outreach clinics (Salina, Hays, Pittsburg, and Topeka Kansas) were included. Patients were excluded if visits were canceled greater than one-half day prior to the appointment, or there was knowledge of a sudden unexpected illness or emergency preventing the visit.

Study design. To test the effectiveness of NS notification upon rates of a subsequent successful encounter, a prospective, non-randomized study was conducted involving two patient study groups. The Control group

consisted of a non-intervention group that was used to establish baseline NS rates, baseline rates of successful subsequent encounters, and time to be seen. The Intervention group included patients where written NS notification was mailed to the referring office within two weeks of the missed visit. For each group, all appointments within two consecutive four-month time periods were reviewed for NSs.

The Control group was evaluated first, followed by the Intervention group. For both groups, each NS patient was tracked using practice electronic medical record appointment lists for up to seven months following a NS to detect successful encounters. We chose seven months because our next available appointments were generally less than three months, thus most patients should have been able to reschedule within this time-frame.

As per standard practice, all patients were reminded of the upcoming visit (in writing or by phone) and families were contacted to reschedule a missed appointment. A secondary endpoint included the effect of NS notification on time to successful encounter. Other data collected included the referring diagnosis and whether patients were established or new referrals, or local versus outreach patients.

Statistics. Group differences were assessed by either a two sample, one-tailed z-test for proportions (95% confidence level) or a non-paired, one-tailed t-test for continuous variables. A p-value of less than 0.05 was required for statistical significance. Descriptive data are reported as means +/- standard deviation (SD) for continuous data or as percentages for categorical data**.**

Results

Referring practice survey regarding no-show notification. Surveys were mailed to 151 actively referring primary practices prior to any patient data collection. A total of 26% of practices returned a completed survey (n = 39). Results indicated that 43.7% of practices routinely receive NS notification by subspecialists, 43.5% learn of the NS at the next visit but are not informed by the subspecialist, and 12.8% may never be informed by either the family or subspecialist (Table 1). All, but one, of the respondents preferred written NS notification. If aware of the NS, 69% of respondents would contact the family to investigate as necessary, 15% would reschedule without calling to investigate, 15% would let family reschedule, 0.8% would let referral center reschedule.

When asked about who has primary responsibility for mitigating the missed visit, 10% of respondents checked both referring center and family. Of the total responses, 43% believed the referring center should remedy the NS. However, an equal number indicated that the family holds responsibility (43%). The remaining indicated that either the care team or family were jointly responsible (14%) or were not sure (10%).

A majority indicated that consults should be cancelled for more than three NSs (67.5%) whereas the remaining was either opposed to cancellation or unsure. Regarding why a practitioner may or may not initiate family contact once aware of the NS, 69% would intervene based upon perceived acuity of the patient's complaint or physical finding, 20% would always call the family, and 11% would call if time allowed.

Effect of no-show notification on rates of successful encounters. The Control group consisted of 633 total referrals where the NS rate was 10% (n = 65; Table 2). The Intervention group included 623 referrals with a NS rate of 13.5% (n = 84; p = 0.1). The distribution of new versus established referrals and local versus outreach patients were similar between groups. For both groups, NS rates were lower at outreach

Table 1. Summary of physician survey responses.

	% of Responses
Current Mode of Notification about a No-Show	
By referral center	43.7
At patient follow-up	43.5
Never found out	12.8
Practitioner Response to No-Show Notification by Referring Center	
Reschedule appointment	15.0
Call family	69.2
Allow referral center to reschedule	0.8
Allow family to reschedule	15.0
Who holds responsibility for missed visits? *	
Referring center	43.0
Referral center	0.0
Family	43.0
Not sure	10.0
All	14.0
Opinion of cancelling referrals in setting of chronic non-compliance (> 3 missed visits)	
Yes	67.5
No	2.8
Not sure	29.7
What would influence decision to call family following no show notification?	
Patient acuity	69.0
Always call	20.8
Available free time	10.2

* Some respondents selected more than one answer.

clinics compared to the university clinic (Control, p = 0.02; Intervention, p = 0.01). Only one subject had more than one NS within the study period (only one NS counted for study purposes).

Reasons for referral are summarized in Table 2. Among those missing cardiology appointments, known or suspected congenital heart disease was the primary referring diagnosis (32%) for both groups (p = 0.5). Other common diagnoses included electrocardiogram or rhythm concerns (13-15%), serious familial heart disease (4.6-7.1%), orthostatic instability (4.7-12%), or chest pain (2.4 - 9%).

Overall rates of successful encounters following a missed visit was 28% (19 of 65) for the Control group and 11% (11 of 84) for the Intervention group (p = 0.1). Among Control patients with known or suspected congenital heart disease, 28% (12 of 43) were seen eventually whereas only 11% (8 of 73) of Intervention patients were seen (p = 0.08). There were no group differences in subsequent follow-up rates comparing either the university versus outreach practices (p = 0.2) or established versus new referral patients (p = 0.43 and p = 0.52, respectively). However, mean time to successful encounter was shorter in the Intervention group (1.65 months +/- 0.9) compared to the Control group (2.9 months +/- 2 ; p = 0.045).

Table 2. Characteristics of patients that missed visits.

	Control	Intervention	p value
Referring Diagnoses (%)			
Suspected/Known Congenital Disease	32.0	32.0	0.50
Non-Congenital Referrals	68.0	68.0	0.50
Chest Pain	9.0	2.4	
Rhythm/EKG	15.0	13.0	
Dizzy/Syncope	12.0	4.7	
Family History	4.6	7.1	
Hypertension	1.5	7.1	
Dyslipidemia	3.0	2.3	
Pulmonary Hypertension	0.0	0.0	
Marfan Syndrome	0.0	1.2	
Other	4.6	6.0	
Referral Demographics (%)			
Local	44.6	33.4	0.42
Outreach	55.4	66.6	0.30
Established	41.5	43.0	0.60
New	58.5	57.0	0.49
Successful Encounters following a Missed Visit			
% Total Successful encounters	28.0	11.0	0.27
% Suspected congenital disease seen	31.0	15.0	0.08
Time to encounter (months)	2.9 +/-2	1.65 +/- 0.9	**0.045**

Discussion

This pilot study addressed the pediatric practitioner's perspective on visit non-compliance to a cardiology subspecialty clinic. The results were similar to previous findings in that NS rates in a subspecialty clinic were relatively high despite visit pre-notification.[1-4] Unlike prior studies assessing adult primary practitioner's opinions about NS notification, most pediatric offices indicated that they likely would intervene if a NS was known.[6] In contrast to our expected outcome, NS notification did not result in more successful encounters following a NS. Reasons were not clear. In some cases, the reason for the initial referral no longer may have existed, the family sought attention elsewhere, or the family relocated.

It was concerning that a majority of patients from both groups with either suspected or known congenital heart disease were not seen despite standard attempts by our practice to contact families. It was not unexpected that university NS rates were significantly higher compared to outreach as the university practice sees a primarily inner city population where socioeconomic factors may influence show rate.[7] Intervention patients were seen sooner compared to the non-notification Control patients suggesting that NS notification, based upon survey

results, may have played a role in both rates of and time to a successful encounter.

The most common reason patients miss appointments is forgetfulness.[7-9] Other explanations include resolution of symptoms, frustration with healthcare, lower socio-economic class, inadequate insurance, inconvenience, and long wait times.

Appointment reminders and/or incentives (free parking) result in modest improvements in NS rates (0-40%).[10,11] Potential barriers to the success of these interventions may include lack of a permanent residence or continuous phone service. Exit interviews describing consequences of visit non-compliance such as referral cancellation or a cash penalty reduce subsequent NS's by approximately 5%.[12] When patients schedule their own appointments, NS rates also improve.[13] However, scheduling an appointment can be daunting in face of language barriers, anxiety about the appointment, or transportation issues. Same day (walk-in) appointments are also effective, but may not be practical for high volume practices.[14]

In contrast to the multitude of studies characterizing patient factors resulting in missed appointments, there are few studies evaluating how NSs are viewed and managed by the primary care team.[15-18] Although data are limited, survey and focus group data of primary practices suggested that patient factors were perceived as the main determinant for visit non-compliance as opposed to any practice factors.[17] Such attitudes by health care teams may correlate with design of interventions that implement consequences for NSs (penalty or fine) rather than implementing changes at a practice level.[17] Indeed, such measures lead to a modest impact on NS rates but effects are incomplete.[12]

Some physicians reported that confronting patients about NSs may compromise the doctor-patient relationship.[17] These concerns require further investigation to overcome this perceived barrier to communication. Our data suggested many practitioners would take responsibility for mitigating a NS, but an equal amount of respondents suggested that the family holds some responsibility in keeping the appointment. Whereas most surveyed pediatric respondents would attempt to contact families following a NS, the majority also indicated referrals should be cancelled as a result of chronic non-attendance. Thus, perceptions regarding visit non-compliance remain complicated.

Contacting patients immediately following a missed subspecialty visit may be routine for many referral centers and may prompt patients to reschedule the appointment.[4,15] Unfortunately, limited data suggested that a majority of patients may never be seen by the subspecialist. A phone survey of NS patients conducted by Ritzler et al.[15] showed that only 47% of NS patients were seen elsewhere or had rescheduled. Indeed, some patients who were not seen may have reasonable justifications especially if they believed the visit was unnecessary or were dissatisfied with a previous encounter.[16] Regardless, greater patient communication, even if as simple as visit reminders, leads to fewer NSs compared to no communication.[18] To this end, by providing NS notification, the referring physician may play a critical role in investigating the NS, reassessing the need for the referral, and/or helping to eliminate barriers to keeping the visit.

Limitations. NS notification did not result in more patients being seen by the cardiologist following the initial missed visit as expected, but the Intervention group was seen sooner than non-notification controls. Because our study was small and only a minority of referring offices responded to the survey, we cannot be certain that the shorter time to follow-up was related to

actions by the referring center in any or all instances. Preferred physician availability in our office and/or visit convenience also may have played a role. The referring office survey was non-validated, however, questions reflected content of prior publications.[6] Finally, we cannot exclude the possibility that the use of the survey prior to the intervention influenced practitioner behavior and study outcome.

An important follow-up study would assess subsequent show rates between offices that act upon NS notification versus those that do not. Routine NS notification seems justified to improve physician-to-physician communication and enhance communication with the family. Advances in electronic medical record systems should automate NS notification and minimize additional workloads for referral centers.

Conclusion

Although our study intervention of NS notification did not result in a greater number of successful encounters following a missed visit, referring centers seemed interested in obtaining NS notification and likely would contact the family to explore reasons behind the missed visit. NS notification may have led to earlier follow up compared to the non-notification group. Knowledge of a NS would help the referring practitioner reinforce the importance of a visit for patients judged to have the greatest risk for significant cardiovascular disease.

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Keywords: patient compliance, referral and consultation, pediatrics, cardiology

Appendix

Missed Cardiology Appointments: Survey

1. **Are you usually informed about missed subspecialty visits?**

   Yes No

2. **How would you prefer to be notified of a missed visit by the referral center?**

   Letter Phone Other

3. **When a missed visit is recognized, would you:**

   a. Call the referral center to reschedule

   b. Ask the patient/family to call the referral center for a new appointment

   c. Wait for the referral center to re-schedule to patient

   d. Allow the family to decide whether or not to keep the appointment

   e. Other

4. **What would influence your decision whether to contact the family after a missed visit?**

5. **Who may be most influential in making sure missed appointment are eventually kept?**

   Referring physician Patient/family Referral Center Not sure

6. **Should referral centers cancel consults after continued visit non-compliance (> 3)?**

   Yes No Not sure

Kikuchi Disease: A Unique Case of Fever of Unknown Origin

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Introduction

In the setting of fever of unknown origin and diffuse lymphadenopathy, it is important to rule out rheumatologic causes, malignancies, as well as atypical infectious causes. Fever of unknown origin and lymphadenopathy can be associated with a number of infectious etiologies, including herpes simplex virus, Epstein-Barr virus, cytomegalovirus, *Bartonella henselae*, *Mycobacterium tuberculosis*, *Toxoplasma gondii*, and *Francisella tularensis*.[1-3] Neoplasms such as non-Hodgkin lymphoma, Hodgkin lymphoma, and various forms of metastatic carcinoma can present with similar symptoms as well.[1-4]

Kikuchi disease is an uncommon disease, typically with a higher incidence in Asian populations.[2] While this disease can appear at any age, there is a greater predisposition for it to appear between the second and third decade of life. Additionally, it typically has a slightly greater predisposition to appear in females with a 1:1.1 to 1:1.4 male to female ratio. Because of these epidemiological facts, the diagnosis of Kikuchi is challenging. We present a patient with an atypical presentation of a rare disease.

Case Report

A 58-year-old white male was transferred to our hospital for further evaluation of his fever of unknown origin. Initially, he presented to another hospital with a three-week history of fever, chills, myalgias, and overt fatigue. The patient endorsed these as new symptoms, saying he never experienced similar ones. His past medical history was significant for mitral valve prolapse, recurrent hernias, hyperlipidemia, and prostate cancer status post resection. He had no past medical history of other malignancies or rheumatologic disease. He was married, worked as an electrical engineer, had never been a smoker or experimented with illicit drugs, and had five to seven drinks of alcohol per week.

The patient's family history was significant for Burkitt lymphoma in a brother. He confirmed travel to Arizona several months prior to the onset of his symptoms. Workup at the outside hospital was not suggestive of any specific etiology for his persistent fever. He had negative blood cultures, urinalysis, and chest x-ray. He had negative serologies for Cryptococcus, cytomegalovirus (CMV), Bartonella, Brucella, Coxiella, Rickettsia, Tularemia, and Ehrlichia. He was negative for Cryptococcus antigen and had a negative polymerase chain reaction (PCR) assay for Epstein-Barr virus (EBV). He was also negative for extractable nuclear antigen and anti-double-stranded DNA and had a normal serum protein electrophoresis and rheumatoid factor.

A bone marrow biopsy with flow cytometry was negative for malignancy as well as acid-fast bacilli staining. Treatment with vancomycin, nafcillin, gentamycin,

ceftriaxone, daptomycin, doxycycline, and fluconazole were employed, but his fever and associated symptoms lingered. Additionally, an abdominal laparoscopic lymph node biopsy suggested reactive lymphadenitis. Finally, a transesophageal echocardiogram confirmed mitral valve prolapse but showed no evidence of any vegetations. Concerned for a more serious or rare etiology, he was transferred to our institution for further management.

Assessment. On admission, the patient was in no acute distress and answered questions appropriately, albeit with a flat affect. Vital signs included a temperature of 36.7°C, pulse of 87 beats/minute, blood pressure of 113/74 mmHg, 18 resting respirations, and an oxygen saturation of 96% on room air. A small, palpable sub-centimeter left submandibular lymph node and a small, palpable sub-centimeter left supraclavicular lymph node, both mobile and non-tender, were noted on his head and neck. Lungs were clear to auscultation bilaterally. Cardiac exam showed his heart had a normal rate and rhythm with a grade IV/VI holosystolic murmur, auscultated best at the apex, with radiation to the axilla. Abdominal examination was notable for laparoscopic port incisions, which were clean, dry, and intact. A diffuse maculo-papular rash with sparing of palms and soles, but with facial involvement, was noted. No focal neurological deficits were noted.

Admission laboratory results showed mild anemia with a hemoglobin of 11.9 g/dL, leukopenia with a white blood cell count of 1700 U/L, but with bands comprising 18% and lymphocytes 21%. An increase in lactate dehydrogenase was noted with a level of 982 U/L. A peripheral blood smear showed normocytic/normochromic anemia without schistocytes, absolute neutropenia without abnormalities, and mild thrombocytopenia. He had an elevated erythrocyte sedimentation rate of 30 mm/hr. Blood and urine cultures were repeated, though there was no growth in either.

Due to the rash seen on admission, dermatology was consulted and they obtained skin shave and punch biopsies. Surgical pathology of skin biopsies showed vacuolar interface dermatitis and purpura, consistent with a possible autoimmune etiology. Additional serology testing returned negative for Blastomyces, Coccidioides, human immunodeficiency virus (HIV), and hepatitis A, B, and C. A cytomegalovirus PCR was negative as well. With no evidence of infective etiologies for the persistent fever, hematology suggested a positron emission tomography (PET) scan to evaluate the lymphadenopathy.

Diagnosis. A PET scan indicated extensive lymphadenopathy pattern suggestive of lymphoma (Figure 1). Thus, biopsy of additional nodes was suggested. The biopsy showed necrotizing lymphadenitis in mesenteric and axillary nodes and karyorrhectic debris in the axillary node only (Figures 2 and 3). These findings were consistent with Kikuchi disease. Flow cytometry of the lymph node biopsies showed normal B-cell populations with no evidence of monoclonal expansion, normal antigen expression, and normal CD4:CD8 ratios. A bone marrow aspiration with flow cytometry to exclude leukemia showed a normocellular marrow with trilineage hematopoiesis, mild dyserythropoiesis, and 1% blasts, along with markedly decreased iron stores consistent with iron deficiency anemia.

Discussion

Kikuchi disease has a world-wide distribution with a wide age of presentation. Dorfman and Berry reported a mean age of 30 in their review of 108 cases, with a range of 11-75 years of age.[5] The primary manifestation of Kikuchi disease is

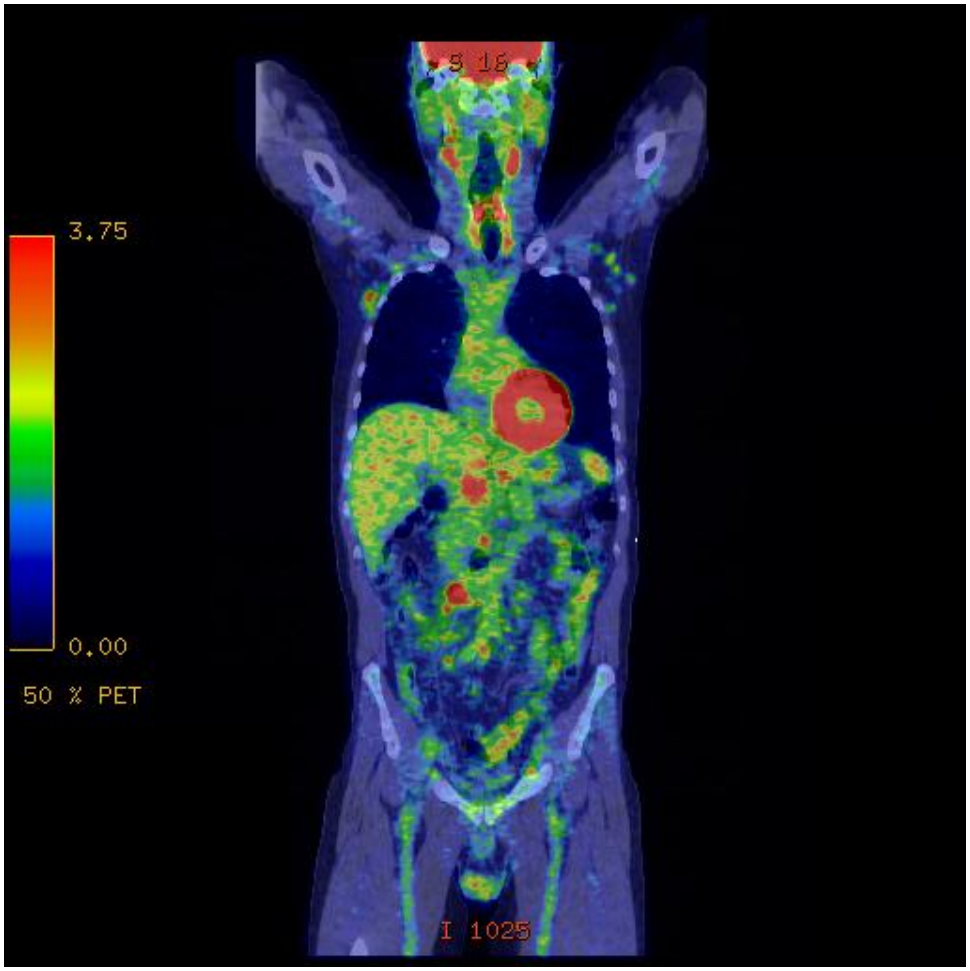

Figure 1. Multifocal areas of increased uptake on PET scan.

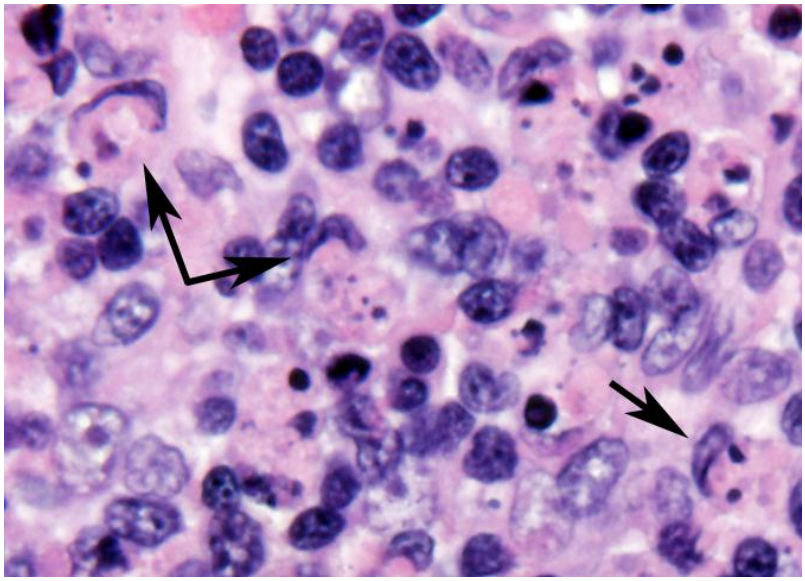

Figure 2. Lymph node biopsy with necrotizing lymphadenitis.

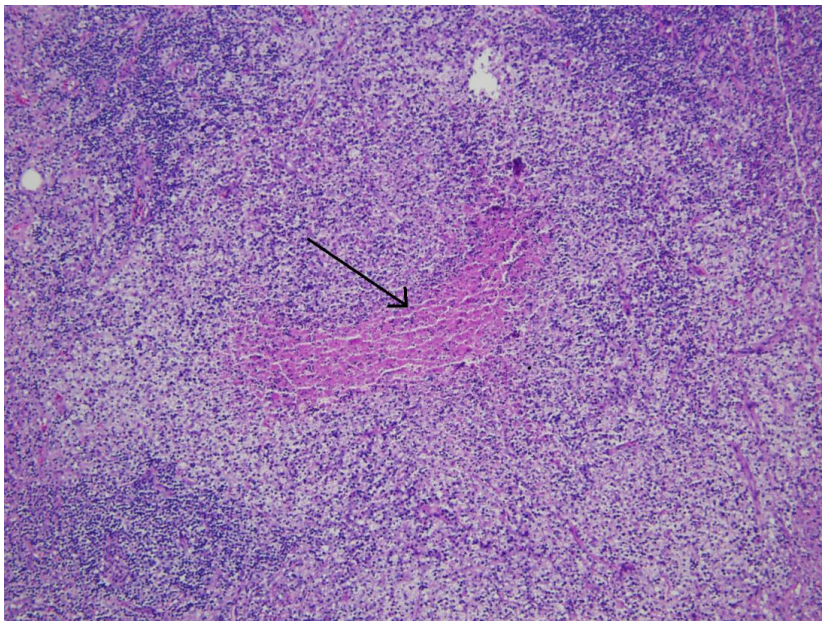

Figure 3. Lymph node biopsy with necrosis.

lymphadenopathy, which primarily occurs in the cervical and supraclavicular region, and is typically unilateral.[1,6-8] However, lymphadenopathy has been described in other case reports of axillary, thoracic, peripancreatic, retroperitoneal, and inguinal lymph nodes.[1,2,6,7] Most cases have relatively small lymphadenopathy, usually with nodes less than 2 cm wide.[1,2] Fever is also a common manifestation and can be the presenting symptom.[1] Skin rashes can take a number of forms including erythematous papules, plaques, acneiform or morbilliform lesions, and facial erythema,[2] and importantly, often can be suggestive of autoimmune pathology on biopsy.[9] Along with the clinical rash presentation[1,2] and association with co-existing lupus,[7,10] it is important to exclude rheumatologic causes as part of the differential diagnosis or as possible comorbidities with Kikuchi disease.

Kikuchi disease has some unique histopathologic findings, primarily in the form of irregular paracortical areas of coagulative necrosis with abundant karyorrhectic debris, distortion of nodal architecture, histiocytic proliferation at the margin of necrotic areas, and karyorrhectic foci formed by different cellular types, including histiocytes, plasmacytoid monocytes, immunoblasts and small and large lymphocytes.[11] However, atypia commonly can be present in the reactive immunoblastic components and can be mistaken for lymphoma.

In this particular case, the patient received a thorough workup at the outside facility prior to transfer, including a lymph node biopsy. The diagnosis was not made initially, likely due to the rarity of the disease combined with the fact that this patient was atypical from an epidemiologic standpoint.

There is no treatment or therapy that has proven effective in the treatment of Kikuchi disease. Typically, there is complete resolution of symptoms within one to six months of presentation.[5] A relatively low recurrence rate has been reported, roughly 3-4%.[5] Recurrence may be reduced with prednisolone, but the evidence is insufficient to recommend its use routinely. Antibiotics such as ciprofloxacin and minocycline may have some benefit, though the evidence is

scarce.[12] Symptomatic measures aimed to relieve the distressing local and systemic complaints should be employed. Analgesic-antipyretics and nonsteroidal anti-inflammatory drugs may alleviate lymph node tenderness and fever. Because of the association with systemic lupus erythematosus, it is important to maintain follow-up even after the resolution of symptoms to ensure lupus does not develop.

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Keywords: Kikuchi disease, fever of unknown origin, pancytopenia, histiocytic necrotizing lymphadenitis

A Missed Coin Lesion!

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Introduction

Aspiration of foreign objects is not uncommon in children or adults.[1] Children usually aspirate foreign objects accidentally, whereas adults usually suffer from a neurological impairment, the influence of alcohol, or an underlying psychological disorder.[2] Presentation ranges from benign to more serious, which requires emergent intervention for removal.[3]

Case Report

A 62-year-old male with paranoid schizophrenia, depression, and neuroleptic-induced extrapyramidal symptoms presented to the emergency department with complaints of coughing blood. He had intermittent dark bloody expectorations, with no associated fever, chills, or increase in sputum production. He denied any previous exposure to tuberculosis. A tuberculin skin test was negative. History was relevant for asbestos exposure. He denied any foreign body ingestion.

A postero-anterior chest radiograph (Figure 1) initially was interpreted by the emergency physician as showing no acute lesion. The patient was discharged on doxycycline for possible acute bronchitis.

A radiologist reviewed the chest x-ray and reported a round metallic opacity near the right hilum. A computed tomographic imaging of the chest (Figure 2) also revealed a metallic foreign body, probably a coin, which laid in the bronchus intermedius on the right, distal to the origin of the bronchus to the right upper lobe. Bronchoscopy was performed and a penny was removed.

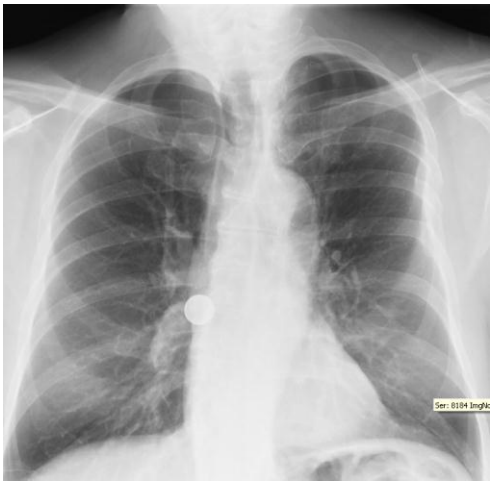

Figure 1. Postero-anterior chest x-ray: A round metallic radiopacity projected over the right paramediastinal stripe at the level of the right hilum.

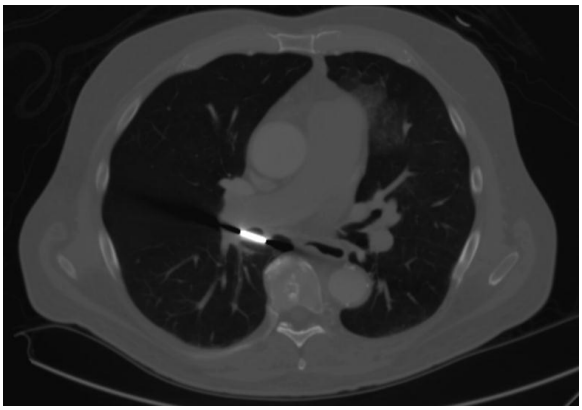

Figure 2. Computed tomography of the chest without contrast: A metallic foreign body lies in the right bronchus intermedius.

Discussion

Intentional ingestion of foreign objects in adults is more common amongst those with mental impairment, psychiatric disorders, or for secondary gain.[4] Presentation usually is deferred and most present with multiple objects aspirated placing them at an increased risk for complications.[4]

A high index of suspicion is important in this population.[1] Diagnosis was only made in 55% of patients prior to bronchoscopy.[5] Chest radiography was only diagnostic in 14% of cases if the object was opaque. Computed tomography scan is usually more sensitive in diagnosing radiolucent objects.[6] Bronchoscopy, either rigid or flexible, is considered both diagnostic and therapeutic.[1,5] Surgery is the final option with good results if there is no parenchymal involvement.[7]

Presentation can be benign or life threatening.[1] Adults, unlike children, do not present with asphyxia but with symptoms of coughing, wheezing, and dyspnea to choking and hemoptysis which can mimic pneumonia or tumor.[5,7] However, obvious hemoptysis is present in less than 15%.[5]

The most common aspirated object is a bone described in 45% of cases.[5] Other aspirated objects include thorns, matches, and organic materials such as nuts, seeds and vegetables.[1,5] Ingested coins also have been described in literature.[2]

A foreign body should be removed once diagnosed irrespective of time of aspiration. The longer the foreign body stays, the worse the morbidity associated with it.[2] The majority of aspirated objects usually are dislodged in the carina and right main stem bronchus.[1,5] If the object was present for a long period, it can migrate and cause endobronchial erosion.[5] With time and chronic inflammation, an aspirated object can mimic an endobronchial mass requiring investigation to rule out bronchogenic carcinoma.[6]

A high index of suspicion for foreign body aspirations is needed in psychiatric patients with respiratory symptoms, even those on optimal psychiatric treatment.[2] If the patient presents late, the only clue for the diagnosis would be past history.

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Keywords: foreign body, respiratory aspiration, psychiatric diagnosis, case report

Severe Thrombocytopenia Associated with HIV-1 Infection: Sustained Response to Zidovudine-Based cART

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Introduction

Thrombocytopenia in association with human immunodeficiency virus (HIV) infection was described in the medical literature even before the term HIV was coined.[1] The authors linked thrombocytopenia to disorders of immune regulation in young men who had sex with men. Thrombocytopenia can be found at any stage during the course of illness with its prevalence ranging from 10-30% for mild thrombocytopenia (< 1.50 x 10^9/L), to 1.5-9% for severe thrombocytopenia (< 50 x 10^9/L).[2,3]

The mechanism producing thrombocytopenia in HIV infection is multifactorial with evidence implicating both the direct and indirect role played by HIV in decreasing platelet turnover and immune-mediated peripheral destruction of platelets. How HIV alters the internal milieu of the bone marrow resulting in ineffective thrombopoiesis is still a mystery. In-vitro studies of megakaryocytes show quantitative and qualitative abnormalities in patients with HIV infection,[4,5] while the peripheral destruction has been attributed to molecular mimicry of immunodominant epitopes of these mutating strains.[6]

The past decade has transformed our understanding of HIV and acquired immune deficiency syndrome (AIDS) and offered a better perspective into its natural history. With the introduction of aggressive combination antiretroviral therapy (cART or highly active antiretroviral therapy, HAART) and continued research towards better therapeutic options, survival in individuals with this once dreaded infection has increased considerably. We report a case of HIV-associated thrombocytopenia who presented with severe bleeding despite being on cART for a considerable period of time.

Case Report

A 35-year-old female presented to the emergency department with complains of menorrhagia, bleeding from the gums, and bruises of three weeks duration over her lower extremities. She was diagnosed with HIV-1 infection four years prior and had been on cART (stavudine, lamivudine, nevirapine) since diagnosis. Her complete hemogram revealed a reduced platelet count of 8 x 10^9/L. She was transfused with platelet concentrate and was admitted for further management.

Her detailed medical history was unremarkable except for a viral flu-like, febrile illness four years prior, during which she was diagnosed with HIV-1. The possibility of horizontal transmission was deduced, since her husband indulged in high-risk behavior and was infected with the same strain. Physical examinations revealed

multiple petechial and purpuric lesions, varying in size between 0.2 to 0.8 cm, localized predominantly to the extensor compartment of the lower limbs bilaterally, extending up to the knees with a few discrete patches over the abdomen. She was asymptomatic with respect to HIV infection and any related opportunistic infection.

Baseline renal and liver functions tests were normal. Her coagulation profile was unremarkable except for prolonged bleeding time (8 min; 32 sec). HbSAg titres and anti-HCV antibody titres were negative. Bone marrow examination revealed megakaryocytic thrombocytopenia. Her absolute CD4 count was 356/mcl and viral load was 10,200 copies/ml.

The patient was started on oral prednisolone 60 mg/day after explaining the potential risks, since the option of intravenous immunoglobulin was declined due to monetary constraints. Additional units of platelet concentrate were transfused until the second day post-admission and were abandoned when active bleeding stopped. Simultaneously, her cART regimen was revamped and she was started on zidovudine, lamivudine, and indinavir. Her platelet count improved in the following days with no evidence of any further bleeding. By the fifth day post-admission, the platelet count was 8 x 10^9/L and she was discharged on the seventh day with a platelet count of greater than 10 x 10^9/L.

The patient was followed weekly with an intention to titrate the dose of prednisolone appropriately. By the end of week 6, she maintained a platelet count of greater than 20 x 10^9/L on 10 mg prednisolone every other day. Her viral load decreased to less than 200 copies/ml and prednisolone was stopped. She maintained complete remission throughout the course of a 6-month follow-up period with platelet counts of greater than 20 x 10^9/L and HIV-RNA copies suppressed to less than 200/ml.

Discussion

The mainstay in the treatment of HIV-associated thrombocytopenia is combination antiretroviral therapy (cART).[7] Life-threatening bleeding is treated with a short course of anti-RhD or intravenous immunoglobulin. Rapid response with dramatic increases in platelet counts is seen albeit short-lived, necessitating repeat administration of these agents to maintain platelet counts in the near normal range.[8,9] Corticosteroids have been tried as a cost-effective modality, but its inability to sustain remission after tapering and the risk of opportunistic infections on continuous use have precluded its widespread use.

Thrombocytopenia of less than 10 x 10^9/L is uncommon in HIV infection, especially in the setting of aggressive treatment with cART. Our patient, who received cART at the outset, had a benign clinical course with suppression of plasma viremia to undetectable levels. The striking feature of this acute presentation was the simultaneous increase in plasma viremia which coincided with severe reduction in platelet count, implying thrombocytopenia may be primarily a manifestation of the active driving force behind this disease-viral replication. Interrupting cART is known to increase the risk of thrombocytopenia.[10] Factors contributing to the decline in platelets after interrupting antiretroviral therapy may include activation of coagulation pathways or HIV-1 replication. However, this possibility was ruled out in our patient since she had regular follow-up and strictly adhered to her treatment regimen. Whether this sudden burst in replication is an early manifestation of drug resistance is debatable.

The observed response seen after initiation of corticosteroid therapy confirms that anti-HIV antibodies played a role in destruction of platelets similar to the mechanism seen in settings of autoimmune

thrombocytopenic purpura.[11] The sustained response manifested as elevated platelet counts for a prolonged period even after the withdrawal of steroids confirms the multi-factorial etiology of HIV-associated thrombocytopenia and implies a role for active viral replication as the etiology of low platelets.

In severe thrombocytopenia, elevated platelet counts are well documented in treatment-naïve as well as ART-experienced individuals after the introduction of cART. Studies have confirmed the efficacy of cART in this regard.[7,12] For decades, zidovudine has been an integral component of cART in severe thrombocytopenia, with its efficacy attributed to suppression of viral load, thereby attenuating the infection of megakaryocytes. Its ability to increase platelet production is thought to play an important role.[13-15]

Plasma viremia in our patient, after the introduction of zidovudine and protease inhibitor to the cART regimen, was suppressed and undetectable after six weeks. Corticosteroids were withdrawn by the end of six weeks. The favorable response beyond six weeks is attributed to the clinical efficacy of modified cART. Although the exact mechanism of action cannot be elucidated, suppression of plasma viremia quantified by serial measurements and corresponding clinical outcome suggest that efficacy of cART in reducing the viral load played an important role.

In an era where our understanding of HIV infection has gone beyond the molecular levels, thrombocytopenia associated with HIV remains elusive. Ongoing research in this field might help understand this condition better. Until concrete evidence is available, it is wise to implement zidovudine-based cART in patients with mild to moderate thrombocytopenia and reserve corticosteroids for life threatening bleeding not responding to intravenous immunoglobulin therapy.

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Keywords: thrombocytopenia, HIV-1, highly active antiretroviral therapy, zidovudine

Uremic Lung: A Rare Entity in the Post Dialysis Era

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Introduction

Uremic pneumonitis, known as "uremic lung", is a complication of end stage renal disease. It rarely is seen these days in developed countries due to access to hemodialysis in patients with advanced renal failure.

Uremic pneumonitis is a clinical entity that was described as early as 1955.[1] Its pathophysiology is based on uremia-induced increased permeability of pulmonary alveolo-capillary interfaces, leading to interstitial and intra-alveolar edema, atelectasis, alveolar hemorrhage, and pulmonary hyaline membrane formation.[2] These changes are compounded by bleeding diathesis secondary to platelet dysfunction in advanced renal disease.[3] The pulmonary symptoms and radiographic findings are reversible with hemodialysis.

We describe the clinical presentation and management of a patient without prior history of kidney disease presenting with uremic pneumonitis.

Case Report

A 23-year-old Hispanic male with an uneventful past medical history presented with complaints of coughing up blood and epistaxis. Symptoms started two weeks prior with chest pain which worsened with breathing, lying on his back, and coughing. It progressed to a productive cough with hemoptysis of approximately one spoonful of bright red blood daily after about a week. He also reported infrequent self-limiting episodes of epistaxis.

The patient felt feverish. He had chills and sweats for one week. Other symptoms included shortness of breath on exertion, loss of appetite, fatigue, nausea, and a metallic taste in his mouth. He denied rash or arthralgias and reported normal urinary output.

He had moved to the United States from Mexico about four years prior and served as a delivery man for grocery stores for one and a half years, then as a construction worker for one year, and most recently had been mowing lawns for about a year. He previously smoked cigarettes and drank about six cans of beer daily until approximately two years prior to presentation. He denied use of illicit drugs. Family history was significant for his mother having hypertension.

On physical examination, the patient was afebrile. He had tachycardia, a respiratory rate of 24 bpm, an oxygen saturation of 97% on four liters by nasal cannula, and blood pressure of 154/90 mmHg. He had marked pallor, was in mild respiratory distress with hyperdynamic precordium, and coarse rales bilaterally on posterior chest auscultation. There was no jugular venous distension, pericardial friction rub, stupor, asterixis, or peripheral edema.

At presentation, his blood urea/nitrogen was markedly elevated at 218 mg/dl with serum creatinine of 41.5 mg/dl. His hematocrit was low with hemoglobin of 4.6 g/dl, and urinalysis showed 4+ proteins, 1+

blood, 2-10 white blood cells, 2-10 red blood cells, and urine protein/creatinine ratio of 11.4. There were no casts noted. An autoimmune work up was inconclusive. Blood counts and serum chemistry are listed in Tables 1 and 2.

Table 1. Serum chemistry at presentation and days 5 and 10 after initiation of dialysis.

Variable	Reference Range	On Evaluation	Day 5*	Day 10*
Sodium	137-147 mmol/L	129	134	139
Potassium	3.5-5.1 mmol/L	3.9	3.1	4.4
Chloride	98-110 mmol/L	93	97	104
CO2	21-30 mmol/L	9	21	27
Blood Urea Nitrogen	8-20 mg/dl	218	136	38
Creatinine	0.4-1.24 mg/dl	41.51	24.32	5.76
Anion Gap	8-12	27	16	8
eGFR	> 60 ml/min/1.73 m^2	1	2	13
Magnesium	1.6-2.6 mg/dl	3.2	2.1	2.6
Phosphorus	2.0-4.0 mg/dl	13.9	7.4	4.0

*After patient underwent hemodialysis.

Table 2. Basic hematological profile at presentation.

Variable	Reference Range	On Evaluation
Hematocrit	40-50%	13.4
Hemoglobin	13.5-16.5 g/dl	4.6
MCV	80-100 FL	83
WBC	4.5-11.0 K/UL	14.9
Platelet	15-400 K/UL	206
PTT	26.1-37.6 secs	31.9
INR	0.9-1.1	1.1

An initial chest X-ray showed symmetric bilateral air space opacities primarily involving the lower lung zones (Figure 1a). Non-contrast computed tomography (CT) of the chest showed diffuse and somewhat symmetric airspace opacities throughout the lungs bilaterally with a predominance in the lower lobes and relative sparing of the upper lobes and along the peripheral margins of the lungs (Figure 1b).

Upon admission, this patient received packed red blood cell transfusions and hemodialysis was initiated. The initial working diagnoses were pulmonary renal syndrome and lupus, but a comprehensive autoimmune work up was inconclusive.

Renal ultrasound showed atrophic bilateral kidneys. An echocardiogram was normal. Blood, sputum, and urine cultures remained negative for any growth. A renal biopsy showed changes suggestive of end stage renal disease and primarily an immunologically mediated glomerulo-nephritis producing a mesangio-proliferative and focally crescentic type of injury (Figure 2).

The patient's pulmonary symptoms and epistaxis resolved with repeated dialysis, as did radiographic evidence of alveolar infiltrates (Figure 3). This was more consistent with uremic pneumonitis rather than the pulmonary renal syndrome.

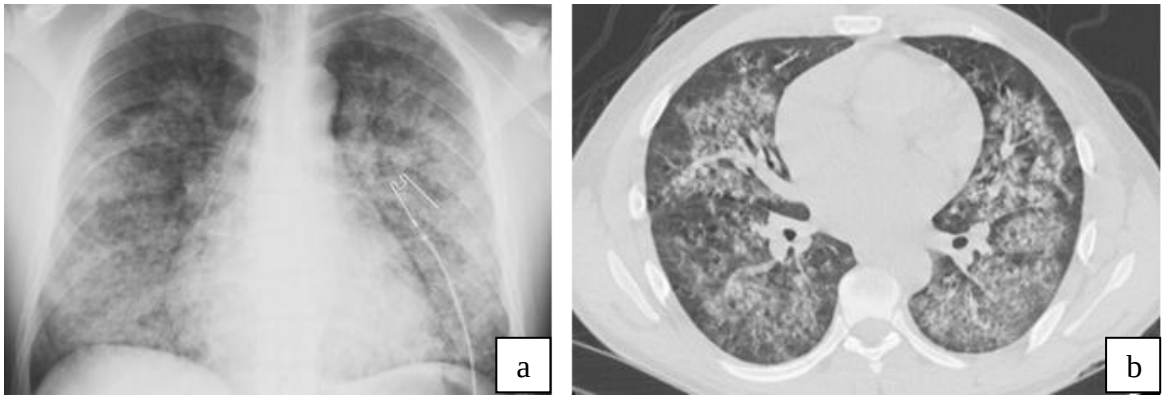

Figure 1. Initial chest x-ray (a) and non-contrast chest CT (b) images at presentation. There was extensive diffuse symmetric bilateral air space opacities primarily involving the lower lung zones characteristic of diffuse pulmonary hemorrhage.

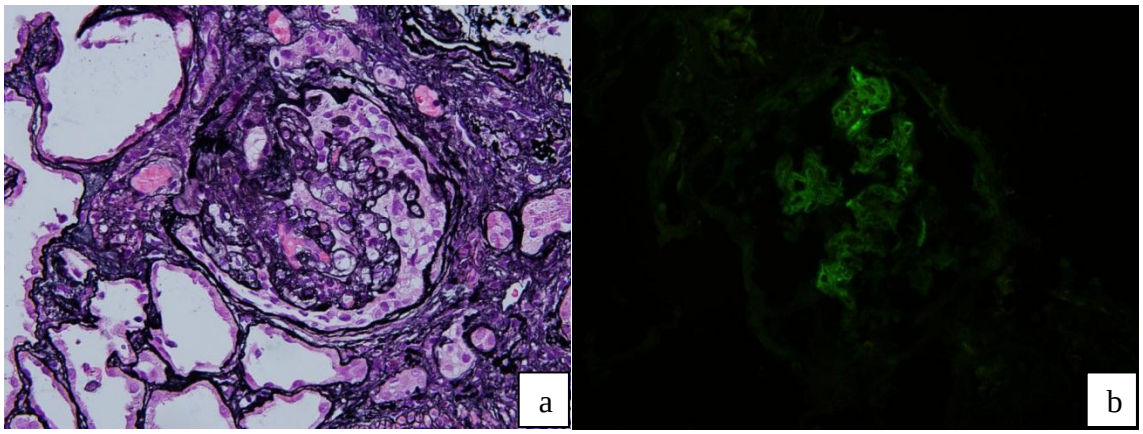

Figure 2. a) Renal biopsy showed a single glomerulus exhibiting a fibroepithelial crescent (periodic acid-Schiff-methenamine silver stain, 400x). b) Immunofluorescence stain demonstrated irregular deposits of C1q along the basement membrane of capillary loops and within mesangial areas (FITC anti-C1q, 400x).

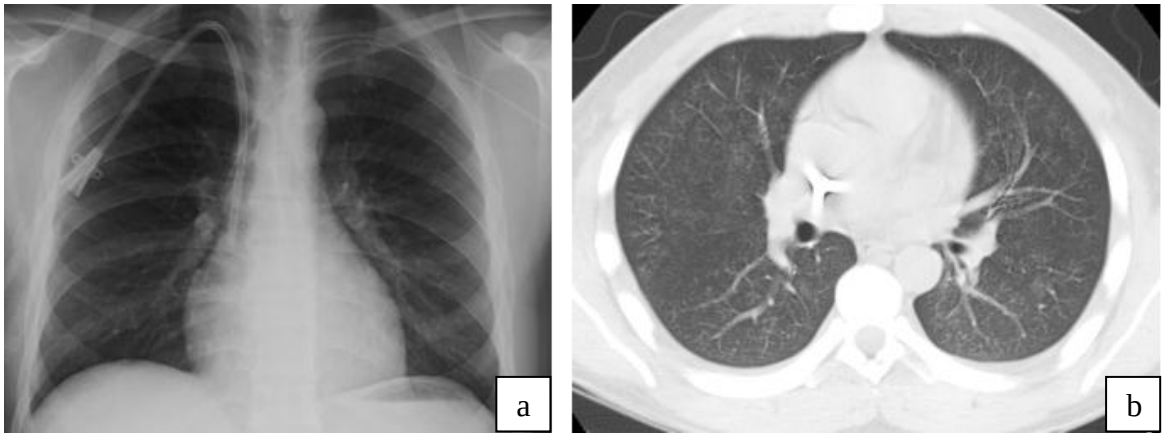

Figure 3. Follow-up chest x-ray (a) and non-contrast chest CT images (b) showed bilateral air space opacities largely resolved following hemodialysis.

Discussion

Uremic pneumonitis, common in the pre-dialysis era with frequent references in medical literature into the 1940s-1960s, is now rare in the developed world with improved recognition and care of renal disease and access to dialysis. Patients typically presented with dyspnea and characteristic and sometimes reversible radiological "butterfly densities" or "bats-wing shadows".[4,5]

This syndrome uniting pulmonary radiological features and uremia previously had been referred to by various names, including "pulmonary azotemia",[6] "pulmonary hyperemia with acidosis",[7] "uremic edema",[8] or "fluid lung".[9] It has been described in association with uremia secondary to severe glomerulonephritis and hemolytic-uremic syndrome, although it is believed to occur secondary to severe uremia from any etiology. Hughes[5] reported on a series of seven cases with characteristic radiographic changes several of which mirror the findings in our patient, including the resolution of opacities following dialysis, coupled with hemorrhagic changes in the lung, and "focal hemorrhages and alveolar albuminous and fibrinous edema".

Our patient neither had a prior diagnosis of renal dysfunction nor long-standing uremic symptoms. However, imaging studies and biopsy results indicated chronic kidney damage with evidence of glomerulonephritis and glomerulosclerosis, suggesting prior untreated or unrecognized renal disease.

In a case series of six patients presenting with pulmonary-renal syndrome without concomitant destructive pulmonary disease, Herman et al.[10] reported two patients with evidence of anti-glomerular basement membrane disease consistent with the Goodpasture Syndrome. Two had idiopathic rapidly progressive glomerulonephritis. One had immune complex deposition consistent with Systemic Lupus Erythematosus and one had vasculitic and immunologic changes consistent with Wegener's granulomatosis.

Our patient had a mesangio-proliferative and focal crescentic glomerulonephritis which likely produced end-stage kidney disease with severe uremia leading to pneumonitis. Severe complications from uremia are more likely to be encountered in patients with limited access to healthcare. Uremic pneumonitis can be protean in presentation and could be confused for other disease entities such as acute pulmonary edema, pneumonia, autoimmune, fungal or metastatic disease.[11] It is important for clinicians to consider this rare condition as part of their differential diagnosis for "butterfly lung" or "bats-wing shadows" in the setting of hemoptysis and renal failure.

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Keywords: uremia, lung, pneumonitis, kidney diseases

Crohn's Disease with Pyoderma Gangrenosum: A Marker of Severity of Disease

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Introduction

Crohn's disease is a chronic inflammatory disorder which is distinct from other inflammatory bowel conditions, such as ulcerative colitis, in its ability to involve the GI tract anywhere from mouth to perianal area.[1] It was long thought as a disease limited to the gastrointestinal tract usually presenting with chronic diarrhea, abdominal pain, weight loss, rectal bleeding, and fever. Intestinal complications include obstruction, fistulas, abscesses, toxic megacolon, malabsorption, and colorectal cancers. Other extra-intestinal modes of presentation, such as upper respiratory tract involvement, retinal detachment, arthritis, hepatobiliary involvement, erythema nodosum, pyoderma gangrenosum, spondylitis, and delayed growth, sometimes are the key to binding multi-system-associated symptoms into the diagnosis of Crohn's disease.[2] These may sometimes pre-date bowel symptoms by several weeks or even years or develop during the course of active bowel disease. Presentation with extra-intestinal symptoms may result in delayed or missed diagnosis.

Pyoderma gangrenosum is a rare neutrophilic noninfectious dermatosis. Etiology remains unclear, however, inflammatory bowel disease is the most common underlying disorder associated with it. The presence of pyoderma gangrenosum usually is a predictor of severity of gastrointestinal disease even without apparent manifestations.[3]

Case Report

A 52-year-old male with Crohn's disease presented with multiple bilateral leg ulcers below the knee (Figure 1). His Crohn's disease was diagnosed 15 years prior and he was taking sulfasalazine. He presented with bleeding from right leg ulcers and bilateral moderate to severe pain. He had episodes of diarrhea seven days before presentation with watery stools 3-4 times daily, which resolved on its own. He had chronic soft stools and not had formed bowel movement for many years. He denied any blood in his stools. He complained of decreased appetite and episodes of intermittent nausea but no vomiting.

On examination, the patient was afebrile and tachycardic with mildly elevated blood pressure. The oropharynx was free of ulcers and erosions. Abdominal examination revealed an obese, nontender abdomen with bowel sounds. Rectal examination was negative for any ulcers or bleeding. The lower extremities were characterized by multiple, irregular, purulent bleeding ulcers below the knee covering both legs circumferentially.

The laboratory evaluation was significant for leukocytosis with 23% bands. The fecal occult blood test was positive for blood. His C-reactive protein and erythrocyte sedimentation rate (ESR) were elevated. Hepatitis serologies and blood cultures were negative. Wound cultures were positive for staphylococcus aureus and

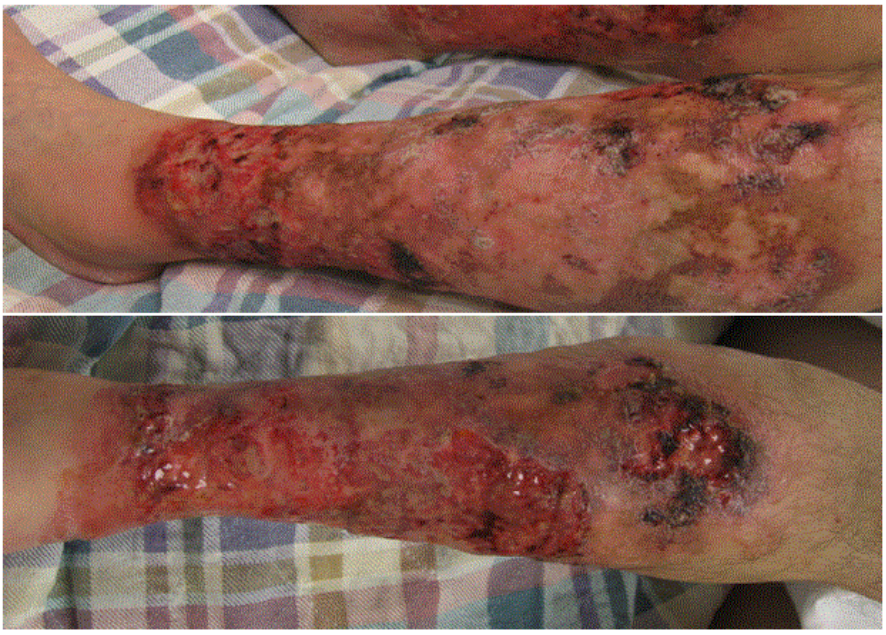

Figure1. Bilateral pyoderma gangrenosum ulcers with circumferential involvement in both legs.

pseudomonas. The Crohn's Disease Activity Index (CDAI) was 232, indicative of disease activity to be in moderate to severe range.

In light of the leukocytosis, the patient was started on intravenous vancomycin and piperacillin/tazobactam along with debridement of wounds with daily dressing changes. Colonoscopy revealed mucosal changes with ulceration and severe congestion as well as pseudopolyp formation within the mid to distal transverse colon, ascending colon, and cecum. The terminal ileum was spared. Biopsies showed evidence of chronic active inflammation, focal acute cryptitis, crypt abscess, aphthous ulcers, and basal lymphoid aggregate with no evidence of dysplasia or granuloma. Rectum and terminal ileum generally were spared.

The patient was switched to cephalexin, ciprofloxacin, and prednisone after completion of seven days of intravenous antibiotics. His leg ulcers improved with prednisone and he was to be started on infliximab after the bacterial infection was resolved. QuantiFERON® testing for latent tuberculosis was indeterminate twice and he was started on antituberculous therapy before infliximab could be initiated. However, his leg ulcers healed and follow-up laboratory evaluation reflected this clinical improvement as evidenced by improvement in anemia, leucocytosis, and erythrocyte sedimentation rate.

Discussion

Crohn's disease is part of the group of inflammatory bowel diseases associated with the NOD2 gene contributing to an inappropriate hyperactive response to intestinal microbes.[4] The disease course has relapsing and remitting episodes of multiple gastrointestinal manifestations from oropharynx to anus, with the ileum and colon more commonly involved. Crohn's disease is associated with multiple systemic symptoms such as arthritis, anemia, malnutrition, and skin manifestations like pyoderma gangrenosum.

First described in 1930, pyoderma gangrenosum is a non-infectious neutrophilic dermatosis.[5] The condition has an idiopathic form as well as one associated with an underlying disease such as inflammatory bowel disease, arthritis, hemato-

logical disease, human immunodeficiency syndromes, and solid tumors.[5,6] Pyoderma gangrenosum is associated with ulcerative colitis, but is rare in Crohn's disease. Pyoderma gangrenosum adds 20 points to the CDAI which includes signs and symptoms, such as the number of bowel movements, abdominal pain, and anemia, and complications, such as arthritis, anal fissure, uveitis, and pyoderma gangrenosum.

Erythema nodosum, on the other hand, occurs more commonly in Crohn's disease.[6] Pyoderma gangrenosum usually begins with fluctuant nodules and an inflammatory halo which expands peripherally to form an ulcer. The ulcer may progress with irregular or sharply circumscribed violaceous raised edges to any of the four prototypic forms: ulcerative, pustular, bullous, or vegetative. The lower extremities and the trunk are most affected sites.[7] Each form may develop into another type or become ulcerative.[8] The diagnosis does not depend on histological biopsy and a clinical-histological approach is required to make the diagnosis and to exclude other ulcerative processes.[9]

The first line of treatment for pyoderma gangrenosum is the use of systemic corticosteroids like methylprednisolone, together with treatment of any underlying cause.[10] Many therapeutic approaches like cyclosporine, mycophenolate mofetil, azathioprine, and tumor necrosis factor-alpha (TNF-alpha) inhibitors are used, however, they have inconsistent results. A common problem is repeated flare-ups in patients with Crohn's disease who become resistant to once stable therapy or become refractory to first line agents (e.g., glucocorticoids, 5-ASAs, and antibiotics). They have relapsing events, such as pyoderma gangrenosum, with repeated episodes of gastrointestinal symptoms.[11] Treatment options like infliximab, azathioprine, and 6-mercaptopurine show increased efficacy, with maintenance of remission, and improvement in quality of life in moderate to severe Crohn's disease refractory to conventional treatment.[12]

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Keywords: Crohn's disease, pyoderma gangrenosum, gastrointestinal tract

Medication-Induced Gingival Overgrowth

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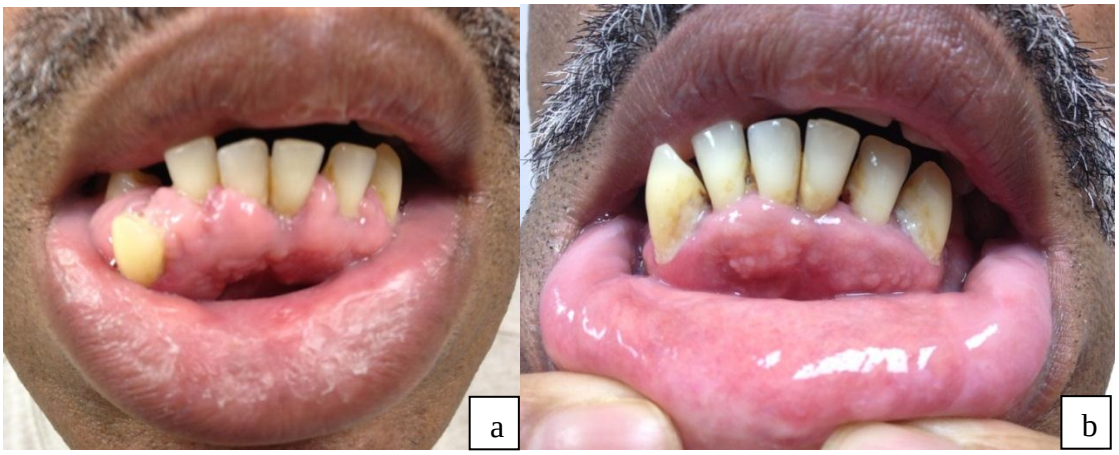

A 59-year-old African-American male with essential hypertension and chronic obstructive pulmonary disease presented to the office for routine visit. The oral exam showed severe gingival overgrowth (Figure a) that caused his right lower canine to shift downward and laterally. No pain, blood, discharge, or halitosis was noticed. However, the patient had moderate plaque disease. He was started on nifedipine 14 months prior and had no observed gingival overgrowth during a previous routine visit seven months prior. A presumptive diagnosis of nifedipine-induced gingival overgrowth was made and nifedipine was stopped. Follow-up six months later showed partial resolution (Figure b).

Discussion

The preferred clinical diagnostic terminology is gingival overgrowth or enlargement. Medication-induced gingival hyperplasia refers to a histologic rather than a clinical presentation.[1] Medications associated with gingival overgrowth fall into three categories: antiepileptics (primarily phenytoin), immunosuppressants (primarily cyclosporine), and calcium channel blockers (primarily nifedipine and verapamil).[2] The gingiva affected by these medications can have hyperplasia and/or hypertrophy. Gingival overgrowth also can occur with other anticonvulsants or immunosuppressants, antibiotics, and oral contraceptives.[3] Causes of gingival overgrowth that are non-medication related include acute myelomonocytic leukemia (M5, myelomonocytic) and Burkitt's lymphoma.

The incidence in the general population is unknown.[4] The exact mechanism of action is not understood. Medications are thought to produce changes in fibroblast function increasing the

extracellular matrix of the gingival connective tissue. Dental plaque causes inflammation and increases the likelihood of medication-induced gingival overgrowth. This process is not related to the systemic dose of the medication, but to its concentration in the saliva and gingival connective tissue. Clinically, it can lead to significant disfigurement and difficulty in chewing and speech.

Treatment for mild or moderate disease includes medication discontinuation or dose reduction in addition to plaque control and good oral dental hygiene.[5] Scalpel gingivectomy remains the treatment of choice in severe cases and necessitates referral to a general dentist or periodontist. Metronidazole, azithromycin, and azithromycin toothpaste have shown variable degrees of success in treatment.[6] A recent study found that oral folic acid decreased the incidence of phenytoin-induced gingival overgrowth in children.[7]

The oral exam is an important part of the general physical exam and commonly overlooked by busy physicians. Promoting oral hygiene, early detection of gingival overgrowth and cessation of the inciting medication are the cornerstones in management of drug-induced gingival overgrowth and preventing its associated morbidity and disfigurement.

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Keywords: gingival overgrowth, nifedipine, substance-related disorders, case report

CLINICAL QUIZ

A Diagnosis Not to Miss!

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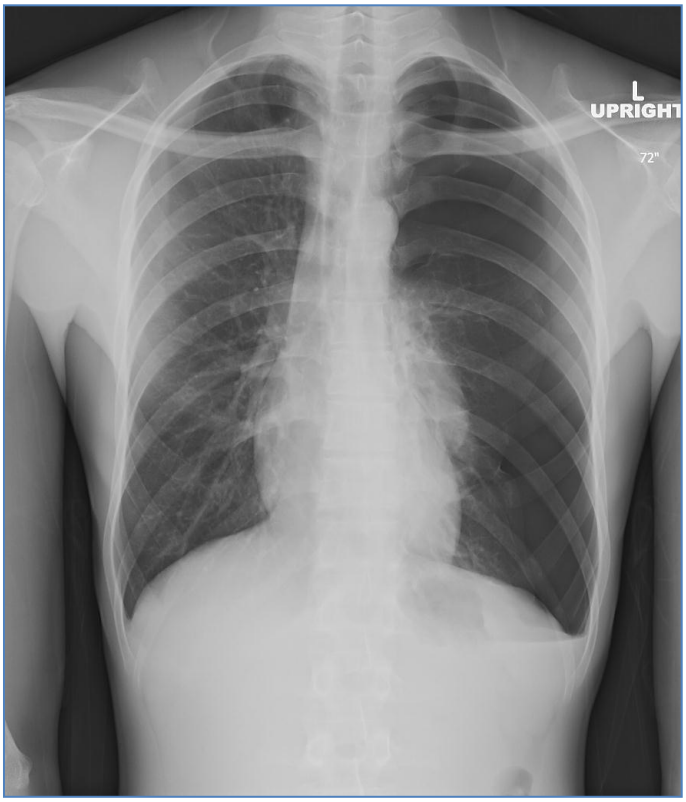
A 25-year-old previously healthy male patient, who was a smoker, presented with a one-week history of cough. He experienced a sudden onset of left-sided chest pain while coughing on the day of presentation. He denied fever, sputum production, recent trauma, or family history of lung disease. He had mild shortness of breath. His exam revealed a thin, tall patient with mild distress. Vital signs were stable. Oxygen saturation was normal. His neck exam showed no abnormalities. The chest exam showed decreased air entry on the left side and hyperresonance to percussion with no local tenderness.



What is the most likely diagnosis?

A. Chronic obstructive pulmonary disease
B. Pulmonary embolus
C. Pneumonia
D. Pneumothorax

Correct Answer: D. Pneumothorax

This patient had primary spontaneous pneumothorax which occurs without an inciting factor in a person with no clinical lung disease.[1] It typically occurs in tall, thin males between the ages of 10 and 30 years. Smoking cigarettes increases the risk of primary spontaneous pneumothorax in men by as much as a factor of 22 in a dose-dependent manner.[2] Clinically, presentation varies from asymptomatic to life-threatening tension pneumothorax according to its size. Chest x-ray shows a white visceral pleural line, which is separated from the parietal pleura by a collection of gas with absent pulmonary vessels. Treatment depends on the size and clinical stability of the patient and includes observation, supplemental oxygen, needle aspiration of intrapleural air, chest tube insertion, and thoracoscopy.[3]

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Keywords: pneumothorax, case report

Commentary

Clinical Practice

Cell Phone Induced Femoral Nerve Neuropathy

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In considering this report, the following adage from medical school days comes to mind. "You cannot make the right diagnosis if you first do not think of it." This is a quote that Dr. Mahlon Delp impressed on me and all of my medical school classmates. Dr. Delp was a long-time renowned teacher, internist, and chairman of the Department of Medicine at the University of Kansas School of Medicine in Kansas City. "Clinical Diagnosis" taught by Dr. Delp to the first semester, third year medical students was the foundation of our clinical years and Dr. Delp made sure we did not take it lightly.

The patient was a 77-year-old white male, 5'8", 140 pounds, actively engaged in farming and ranching. His chief complaint was pain in the left posterior hip and left groin. The patient described aching pain at times in the left leg below the knee in the area of an old compound spiral tibial fracture sustained thirty years before. The pain had been bothersome intermittently over the past five years. The pain generally was "toothache like", but over the previous four months it had become "ice pick like" at times, to the point the patient had to lie down or "go home" and get off his feet to obtain relief. He had used acetaminophen intermittently when "the ache" persisted at night and he could not get rest although usually the pain subsided in the evening spontaneously and by morning he was pain free. During the very hot summer days of 2012, the patient reported that the pain was daily and increasingly severe, usually beginning before or by noon and becoming progressively worse during the afternoon. When the pain was most intense, he also noted a feeling of weakness in his left leg.

His past medical history revealed a 20-year history of glaucoma with pressures controlled by timolol and latanoprost eye drops. PreserVision® vitamins were taken daily for early dry macular degeneration.

On examination, the patient demonstrated no increase in pain on movement of the left leg and hip. There was no limitation of flexion, extension, or rotation of the hip or leg. He was increasingly convinced there must be severe degenerative arthritis in the left hip and by phone consulted a friend, a retired orthopedic surgeon, who suggested obtaining x-rays of the left leg, pelvis, and both hips. These were obtained at the patient's local rural hospital. The radiologist reported only minimal degenerative arthritis in the hip joints bilaterally.

The "right diagnosis" came by accident a week later. While involved in farm work about noon on this particular day, the pain became severe enough the patient decided to lie down for a while in the seat of the pickup. Before lying down, he removed his cell phone from the left front pocket of his jeans and laid it on the pickup dash. After a short nap, he went back to work for the rest of the afternoon. As the afternoon passed, he was aware that the left hip pain was much less severe than usual even though the work was strenuous. That evening, he discovered he had left his cell phone in the pickup. The next day, he intentionally did not carry his cell phone on his person and the pain did not recur. Since that time, the patient has not carried his cell phone on his person and the pain has not recurred to any degree. He reported 90% plus relief from his hip pain with only "occasional" dull aching and some feeling of slight weakness in the left leg.

No similar case reports of cell phone neuropathy could be identified in the literature. In considering this case, several factors may be important:

1. The patient verified that for "years" (10+) he had carried his cell phone in his left front pocket on a nearly daily basis, the phone "turned on" at all times. The prior 20 years he frequently carried a pager, mobile phone, or portable radio in a previous occupation.

2. As a farmer/rancher, he regularly had the phone in his pocket 12-14 hours a day during the busy spring/summer farming season.

3. The worsening of the patient's symptoms occurred during the very hot summer. This may be significant.

4. The pain always went away in the evening and at night (coincidentally with removing the phone from his pocket and placing it in the charger).

5. The pain intensity in retrospect increased incrementally the longer he carried the phone in his pocket on any given day.

6. The immediate relief of the pain syndrome occurred "like flipping a switch" when he ceased carrying the cell phone. He changed no other activity.

7. A cell phone carried in a front jean pocket places it directly over the femoral nerve, artery, and vein as they pass under the inguinal ligament. Depending upon the patient's habitus, particularly in thin individuals, this can be very close to the skin and the underlying femoral nerve.

8. Advancing age and some degree of degenerative osteoarthritis in the hip joints may increase susceptibility to the syndrome of cell phone neuropathy.

9. Following a two-week, pain-free interval (after ceasing to carry cell phone on his person), the patient began carrying a deactivated cell phone (battery removed) of similar size and shape and carried as before in the left front pocket. To date there has not been a recurrence of the pain previously experienced. This effectively rules out "mechanical pressure" as the cause of the neuropathy.

10. Possible adverse effects of electromagnetic non-ionizing radiations (NIR) are known.[1] Some people are more susceptible to exposure to electromagnetic fields than others.

Discussion

The cell phone and related electronic devices have become a part of life. They are amazing tools that have made information and communication available literally at your fingertips. Cell phones and related devices operate by electromagnetic wave energy. Their wave length is in the radiofrequency (RF) spectrum (as are microwave ovens). The energy often is referred to as non-ionizing radiation (NIR) as opposed to the ionizing radiation of radioactive materials. Thus, health risks generally are thought to be minimal. Chronic recurring exposure, however, to bursts of NIR from these devices carried repeatedly in the same location on an individual's body expose that individual to localized accumulative adverse biological effects of the NIR.[1]

There are two separate categories of potential cell phone health risks. First, the health risks of using cell phones. Second, the health risks of carrying cell phones. They need to be addressed separately. First, using a cell phone may cause health risks because it is normally held close to the ear, side of the head, and neck while it is emitting an electronic signal during a conversation. This potentially exposes the brain as well as the local soft tissues to NIR.[1] There is little agreement how to mitigate possible risks while continuing to use the electronic device.

Second, there has been minimal attention regarding the potential health risks associated with carrying an activated cell phone on one's person. When a cell phone is attached to a belt or placed in a pocket/purse, radiation can penetrate the area near the cell phone handset. Radiant energy is absorbed much faster than at your head because soft tissues and organs provide better conductivity than your skull.[2] Other pertinent points include:

1. Your cell phone emits its highest output levels of radiation just before it rings.
2. Your cell phone sends intermittent bursts of radiation even while in stand-by mode. (These give the cellular system information on where your cell phone is located.)
3. Normal clothing has little or no protective effect against NIR absorption into underlying body tissues.
4. Though the radiation strength is greater while using a cell phone, cumulative exposure is much greater from carrying the cell phone.
5. When cell phone towers are widely spread, as in many rural areas, the NIR energy that is emitted automatically by the cell phone is higher.

At the beginning of a call, a cell phone radiates maximum power but quickly reduces the power so the radiated power is sufficient to have a reliable link to the cell tower.[3] Cell phones radiate far less power in urban areas compared to rural areas, because cell phone towers are much closer in urban areas compared to rural areas.

Many factors including age, body build, co-existing conditions, and individual susceptibility may increase the risk of injury from the local effects of close bodily exposure to the NIR from the electronic device. The above variables are difficult to evaluate and measure. As in the case described above, chronic exposure or frequent recurring exposure to NIR from cell phones and other mobile electronic devices carried repeatedly in the same location on an individual's body may expose that individual to localized deleterious accumulative biological effects of the NIR from that device. Our evidence suggested that the adverse effects (e.g., neuropathy) are reversible by simply not carrying the cell phone. Further scientific investigation is needed.

The adverse effects of cell phone usage on sperm count, motility, and viability were reported in 2008 by a group of researchers at the Reproductive Research Center, Cleveland Clinic Foundation, Cleveland, Ohio.[4] Their findings were confirmed by an Australian study.[5] Recently, there was a fine print warning on the materials given to purchasers of iPhones to not carry the device in your pocket.

NIR exposure of the testes is 4-8 times higher when the device is carried in a pants pocket versus in a "hip holder" attached to a belt.[6] Distance greatly affects exposure when it comes to carrying a cell phone, however, a study of 150 men wearing a cell phone carried on their hip approximately 15 hours a day over six years reported an increase in detectable osteoporoses.[6] This was detected in the pelvis on the side where the electronic device was carried. These results suggest that shielding is needed even for "hip holders".

The whole issue of cell phones and cancer is a highly charged topic. One fascinating case focused on a 39-year-old female who habitually carried her cell phone in her bra.[7] She developed a breast malignancy directly under the cell phone exposed breast area. While it may have been coincidental, the malignancy was uncommonly multifocal and mimicked the cell phone in size and shape.

An unreported case of what seems to be a cell phone related malignancy occurred in a 44-year-old western Kansas farmer. For more than six years, he carried a cell phone clipped to the front left jean pocket for ten to fourteen hours a day. He developed a lump on his anterior upper

thigh directly under the cell phone. The lump, initially thought to be a lipoma grew rapidly. On removal, it proved to be an aggressive pleomorphic undifferentiated sarcoma.

The evidence suggests NIR affects cell function.[7] Signal characteristics and the erratic nature of the signal seem to impair the cells ability to repair cellular damage. Over long exposure periods, the accumulative damage may lead to cellular malignant changes in the localized area exposed to NIR. Whether carrying or using cell phones, there is mounting evidence of a connection between cell phones and cancer, whether it be acoustic neuroma, gliomas, parotid tumors, or the above noted breast malignancy and sarcoma.

Certain cell types are more susceptible and younger cells are more sensitive to injury by NIR.[7] Biological injury is not so much related to power as it is to signal characteristics, specifically the above mentioned erratic nature of the signal emitted by cell phones.

Another probable adverse effect from carrying cell phones is referred to as "Cell Phone Vibration Syndrome."[8] It is a widely reported occurrence as a feeling akin to a cell phone's vibration before a ring when there is no cell phone on the body. It mostly has been reported to be a psychological effect (an obsessive disorder). I believe the syndrome to be an early manifestation of a superficial local sensory nerve neuropathy or a residual effect of cell phone neuropathy. It may be described as a dysesthesia (an abnormal sensation) in the area where the cell phone is carried. It is not painful, but is a potent reminder of the potential adverse health effects of cell phones.

Shielding methods are available that significantly reduce NIR to the exposed body area.[2] These shields are not widely distributed. Effective RF local shields function by reflecting or deflecting the NIR when positioned correctly, rather than absorbing or diffusing the RF energy. The nearby body parts and tissues are protected. These reflective materials are effective and most materials are relatively inexpensive. For most individuals, protective shielding is the most practical solution for those who carry the electronic devices on their person.

The adverse health effects associated with carrying a cell phone should be revealed to buyers and users of mobile electronic devices as potential health risks. Shields are simple and effective. When it comes to health risks of carrying cell phones or other electronic devices, there seems to be abundant indications that the only health-wise approach is to shield it, shut it off, or shed it.

Further research and education need to be encouraged as it relates to the health risks of carrying electronic devices. Furthermore, individuals and health care professionals need to consider this diagnosis in evaluating their patients' symptoms.

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Keywords: cellular phone, femoral neuropathy