Evaluation of Community Baby Showers to Promote Safe Sleep

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Abstract

Background. In recent years, Kansas has ranked 40th among all states for worst infant mortality rates. For African American infant mortality, Kansas had the highest rate in the nation. Because of these statistics, initiatives have been implemented to reduce these rates by the KIDS Network, in partnership with the Black Nurses Association and the National Association of Hispanic Nurses. The purpose was to describe participants' knowledge and intentions regarding safe sleep following a Community Baby Shower.

Methods. The Community Baby Shower was targeted to African American women via black churches, physician offices, clinics, black sororities, word of mouth, radio, and print. All Baby Shower participants were asked to complete a brief survey following the shower.

Results. The majority were African American (61%) with a high school diploma or less schooling (63%). Nearly all (97%) planned to place their baby supine for sleep. However, less than half (47%) planned to have the baby sleep in the parents' room in a separate crib. Attendees exhibited high levels of safe sleep knowledge, stated intentions to utilize most safe sleep recommendations, and reported babies would have slept in unsafe environments without the portable crib.

Conclusions. Our Baby Showers were attended by the target audience, who exhibited high levels of safe sleep knowledge, and stated intentions to utilize most safe sleep recommendations following the Shower. However, some participants were resistant to following at least some of the recommendations. Additional venues and other educational strategies may be needed to maximize the uptake of these recommendations.

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Introduction

Following the Back-to-Sleep campaign in the early 1990s, there was a dramatic decrease in the number of infants who die each year from Sudden Infant Death Syndrome (SIDS).[1,2] However, the 2010 United States infant mortality rate ranked highest of any industrialized nation at 5.98 per 1000 live births and nearly 2500 died of SIDS.[3,4] Further, although the number of infant deaths decreased overall secondary to supine sleep position, other types of sudden unexpected infant deaths, including accidental suffocation and strangulation, have increased.[5] This led, in part, to the American Academy of Pediatrics (AAP) revising its guidelines in 2011 to emphasize sleep environment as well as positioning.[6]

In August of 1998, following four infant deaths from unsafe sleep environments, the Cribs for Kids campaign was launched in Allegheny County, PA.[7] This program distributed full-sized cribs and mattresses, along with written educational materials, to low-income families. In the first year of the program, 500 families participated. From 1998 to 2003, the local SIDS rate dropped by 46%.

In Kansas, 15% of all infant deaths are designated as SIDS.[8] The SIDS rate in Sedgwick County for 2010 was 8.2 infants per 1000 live births.[9] In recent years, Kansas has ranked 40th among all states for worst infant mortality rates. For African American infant mortality, Kansas had the highest rate in the nation. Further, over the last 20 years the African American infant mortality rate has remained more than double the Caucasian rate.[8] Because of these statistics, initiatives have been implemented to reduce these rates by the Kansas Infant Death and SIDS (KIDS) Network, in partnership with the Black Nurses Association and the National Association of Hispanic Nurses.

The KIDS Network holds Community Baby Showers twice per year with the goal of improving health and safety outcomes of infants. These events are designed to target groups with disproportionally high rates of infant mortality, such as African Americans and low-income families. Along with education, parents are provided resources to create a safe sleep environment, including a portable crib, wearable blanket, and pacifier. The anticipated results are that parents will know: (1) the ABCs of infant safe sleep (Alone, on their Back, in a Crib), (2) to place their infant supine for every sleep, and (3) to place infants in a safe sleep environment (i.e., crib) when they otherwise would not have.

Although the KIDS Network partners with the national Cribs for Kids initiative (www.cribsforkids.org), the Baby Showers differ in several ways. To begin, parents were offered direct educational counseling to enhance understanding and retention of materials, as only 40% could explain SIDS accurately after reading Allegheny County's program materials. In addition, the cribs provided at the Baby Showers are portable pack-n-plays (safety approved by the Juvenile Product Safety Commission) that support infant weights consistent with one-year weight ranges. The portable cribs facilitate the "shared room, separate bed" AAP recommendation. These cribs are moved easily from one room to another and fit better because they are smaller than standard cribs. Offering portable cribs to low-income, at-risk families, which could be used by other child care providers (e.g., grandparents or childcare) was identified as important. Finally, the Baby Shower format was selected as group educational luncheons for pregnant women have been shown to enhance self-esteem, reduce isolation, promote peer bonding, and provide important information.[10]

The purpose of this study was to describe participants' demographics, as well as knowledge and intentions regarding safe sleep, following a Baby Shower.

Methods

The Community Baby Showers were targeted to African American women via black churches, physician offices, clinics, black sororities, word of mouth, radio, and print. All Baby Shower participants were asked to complete a brief survey following the shower. The study was approved by two local Institutional Review Boards.

Results

Of the 184 participants in the Baby Showers, 180 (98%) completed the surveys. Ninety-seven (53.9%) attended the October 2011 shower and eighty-three (46.1%) attended the January 2012 shower. Attendees were born between 1963 and 1996, with 50.5% (91) born in the 1980s and 33.9% (61) born in the 1990s. Seven (3.9%) chose not to provide their birth year. The majority were black (109; 60.6%) with a high school diploma or less (114; 63.3%; see Table 1). Most mothers reported not smoking during pregnancy (155; 86.1%).

Table 1. Participant characteristics.

Characteristic	N (%)
Race	
Black	109 (60.6%)
White	45 (25.0%)
Other	6 (3.3%)
No Response	20 (11.1%)
Ethnicity	
Hispanic	18 (10.0%)
Non-Hispanic	29 (16.1%)
No Response	133 (73.9%)
Education Level	
Some High School	34 (18.9%)
High School Diploma	65 (36.1%)
GED	15 (8.3%)
2-Year Community College Graduate	20 (11.1%)
4-Year College Degree	12 (6.7%)
Graduate School Degree	3 (1.7%)
Other	18 (10.0%)
Missing	1 (0.6%)
Intention for Pacifier Use	
Always	14 (7.8%)
Almost Always	22 (12.2%)
Sometimes	120 (66.7%)
Never	17 (9.4%)
No Response	7 (3.9%)
Intention to Breastfeed	
Yes	115 (63.9%)
No	36 (20.0%)
No Response	29 (16.1%)

Knowledge of safe sleep. Parents were asked five questions regarding Safe Sleep based on the information presented at the Baby Shower. Responses to individual questions are presented in Table 2. Because responses did not differ significantly between the October and January Baby Showers they are reported together. Of the 157 participants completing the knowledge items, 53.5% (84/157) correctly answered all five items, 38.2% (60/157) answered four, 7% (11/157) answered three, and 1.3% (2/157) answered two.

Table 2. Correct responses to knowledge items regarding SIDS and safe sleep.

Question	N of 157 (%)
What are the ABCs of safe sleep? (Alone, Back, Crib)	125 (79.6%)
SIDS is the leading cause of death of infants between 1 month and 1 year of age. (True)	156 (99.4%)
After traveling, babies can stay sleeping in their car seat when at home. (False)	148 (94.3%)
The safest place for babies to sleep is in the same room with parents. (True)	115 (73.2%)
Child care providers should create a Safe Sleep policy and communicate it with all parents. (True)	153 (94.5%)

Intentions for baby care and safety. Few mothers (16/175; 9%) planned to continue to smoke after pregnancy, but the majority of those (14/16; 87.5%) planned to smoke only outside. In addition, 21.7% (38/175) reported other members of the household smoked, but mainly outside (32/38; 84.2%). Most planned to breastfeed (115/151; 76.2%) and for their baby to use a pacifier (156/180; 86.7%; see Table 1). Nearly all (152/157; 96.8%) planned to place their baby supine for sleep. However, 52.9% planned for baby to sleep in a separate room (82/155). The remainder (73/155; 47.1%) planned for baby to sleep in a separate crib in the parents' room.

Attendees reported that if they had not received a crib from this program their babies would have slept in an adult bed (137/171; 80.1%), car seat (2/171; 1.2%), sofa (2/171; 1.2%), or other unsafe sleep environments (30/171; 17.5%). Other sleep

areas listed included laundry basket, dresser drawer, floor on a sleeping bag, in bed with other kids, or sleep location was undetermined before the shower. Items that were already in the baby's sleeping areas at home included blankets, bumper pads, pillows, and stuffed toys (33/85; 38.8%). However, 69.2% (101/146) of attendees stated that they would make changes to their baby's sleeping area based on the information received at the Baby Shower.

Intentions for dissemination of knowledge. Participants (144/157; 91.7%) stated that the Safe Sleep for Babies DVD was helpful; the remaining 8.3% left the question blank. In addition, 99.4% (156/157) planned to share the DVD with others. All but one participant, (156/157; 99.4%) felt comfortable sharing safe sleep information with everyone who would be caring for their baby, including child care providers, grandparents, friends, and family. The majority of attendees were Very Satisfied (59.1%; 88/149) or Satisfied (24.8%; 37/149) with the Baby Shower, while the remainder were Neutral (7/149; 4.7%) or Very Dissatisfied (17/149; 11.4%).

Discussion

The Kansas Cribs for Kids program has educated nearly 200 Sedgwick County parents through the Community Baby Showers in the last year. The majority of participants were from our target audience, those with risk factors for SIDS (e.g., young, African American, lower education, non-breastfeeding, without a crib). In addition, these families have received tool kits including a crib, wearable blanket, pacifier, ABCs of Safe Sleep DVD, and other educational materials. Survey results suggested participants had high levels of knowledge following the Community Baby Shower, however, there was still room for improvement. Participants were least likely to know that the safest place for a baby to sleep is in the same room with parents. This may be due to confusion over the difference between room sharing (which is recommended) and bed sharing (which is not recommended).[6,11] However, participants reported that their babies would be sleeping in unsafe locations had they not received a crib from this program. These results were similar to the Allegheny County program where parents reported that without the Cribs for Kids program babies would have slept in the adults' bed (38%), a bassinet (25%), and the remainder on the floor or in a playpen.[7]

The majority of our participants intended to follow safe sleep recommendations and place baby supine, alone, and in a crib. However, small numbers of parents reported plans to place their babies in non-supine positions. It is not clear from this study why participants would choose sleep positions other than supine and should be evaluated further. Less than half of participants intended to have baby in a separate bed in the parents' room. This may be due to confusion over the recommendation (based on response to the knowledge item), or to other, unidentified barriers and also should be examined in future studies.

Finally, participants reported feeling comfortable sharing the safe sleep recommendations with family or other caregivers for their baby. Nearly all reported plans to share the ABCs of Safe Sleep DVD with others. This may indicate that providing parents with tools to enhance their ability to share complete and accurate information with others is important.

Limitations of this study include the self-report nature of the survey, especially due to the fact that survey responses were not anonymous and missing data may have affected our results, in particular those related to race/ethnicity. In addition, we are limited by the lack of pre-intervention knowledge measures, and lack of follow-up

to see if parents actually implemented safe sleep recommendations, utilized the crib, and shared the ABCs of Safe Sleep DVD and educational materials with others. However, results from the Allegheny County survey indicated 100% (n=105) of babies were placed in the cribs to sleep, although only two-thirds of parents reported using the supine position.[7]

In conclusion, our Baby Showers were attended by the target audience, who exhibited high levels of safe sleep knowledge, and stated intentions to utilize most safe sleep recommendations following the Shower. However, some participants were resistant to following at least some of the recommendations. Additional venues and other educational strategies may be needed to maximize the uptake of these recommendations.

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Pulmonary Rehabilitation in Patients with Respiratory Disease

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Abstract

Background. Limited evidence suggests that pulmonary rehabilitation be included in the management of restrictive lung diseases. The purpose of this study was to document pulmonary rehabilitation outcomes in patients with respiratory diseases other than chronic obstructive pulmonary disease (COPD).

Methods. Clinical outcomes of 31patients with respiratory diseases other than COPD and 190 patients with COPD, seen over a 35-month period, were reviewed retrospectively. Patients were evaluated for a 6-minute walk, arm curl strength, chair stand strength, the St. George's Respiratory Questionnaire (SGRQ) total score, SGRQ symptom scores, SGRQ activity levels, and SGRQ impact of respiratory illness on the patient's life. Outcome measures were obtained before the start of pulmonary rehabilitation and after a minimum of nine therapy visits.

Results. Pre- and post-rehabilitation changes in the 6-minute walk, arm curl strength, chair stand strength, the St. George's Respiratory Questionnaire (SGRQ) total score, SGRQ symptom scores, SGRQ activity levels, and SGRQ impact scores improved significantly for both groups. However, non-COPD patients achieved significantly higher mean SGRQ impact scores and arm curl strength than patients with COPD.

Conclusions. Pulmonary rehabilitation should be recommended for all patients with respiratory disease, not only those with COPD.

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Introduction

Many patients with obstructive lung diseases have activity limitations and deconditioning as a result of their poor lung function and dyspnea.[1] In 2000, the American Thoracic Society issued a consensus statement supporting pulmonary rehabilitation in idiopathic pulmonary fibrosis (IPF) patients.[2] In 2007, the American College of Chest Physicians and the American Association of Cardiovascular and Pulmonary Rehabilitation published a Grade 1 B evidence of recommendation for pulmonary rehabilitation (PR) in patients with chronic lung diseases other than COPD.[2]

Further study is needed to understand the benefits of PR in non-COPD patients. Limited evidence suggests that PR should be added within the management algorithm of restrictive lung diseases to reduce morbidity and lower the cost burden. The purpose of this study was to document the outcomes of PR in patients with respiratory diseases other than COPD and compare them to those with COPD.

Methods

A retrospective review of PR outcomes was conducted in patients with respiratory disease other than COPD who were enrolled in a hospital-based pulmonary rehabilitation program between January 2009 and November 2011. These outcomes were compared to patients with COPD seen in the same program over the study period. Subjects completed a minimum of nine therapy sessions and were between the ages of 18 to 75. Exclusion criteria included recent myocardial infarction, decompensated heart failure, terminal cancer, disabling cardiovascular accidents, dementia, alcoholism, pregnancy, prisoners, and age less than 18 or greater than 75.

An order from a licensed physician was required for evaluation and treatment. Each subject had an initial evaluation visit performed by a respiratory therapist or registered nurse to verify the patient was an appropriate candidate for pulmonary rehabilitation. Baseline outcome measures were obtained at that visit.

The 6-minute walk evaluation was completed according to American Thoracic Society Guidelines.[3] An arm curl test was performed using a bicep curl movement with a hand weight. Men used an 8-pound weight; women used a 5-pound weight. The maximum number of full bicep curls completed in 30 seconds was recorded. The chair stand test was performed using a designated chair. Patients were instructed to rise from seated position to a full stand position, without using arm swing or push for assistance and maximum number of sit to stand movements in 30 seconds were recorded.

The patient's quality of life was assessed using the St. George's Respiratory Questionnaire (SGRQ). It is a 16-item questionnaire measuring health impairment in patients with lung disease. The questionnaire assessed patients' 1-month recall of respiratory symptoms, activity disturbance, and impact of respiratory status on their lives.

Data from these variables as well as history and physical exam were used to create an individualized treatment plan for approval by the patient's referring physician and the PR medical director. After the initial evaluation, patients returned for twice weekly visits for breathing retraining, education to improve self-management of lung disease, exercise training, and social support. After finishing a minimum nine sessions of pulmonary rehabilitation, measurements were repeated to compare with the baseline. The comparison of patient variables before and after the program provided the data for this study.

This study was approved by the institutional review boards at Via Christi Health and the University of Kansas School of Medicine-Wichita.

Data were analyzed between groups for each outcome variable using an analysis of variance for independent samples. Data were analyzed within groups for each outcome variable using a repeated measures Student t. Demographics were analyzed by Student t tests.

Results

Thirty-one patients with respiratory disease other than COPD and 190 patients with COPD met study criteria. Diagnoses in the non-COPD group included bronchi-ectasis (n = 1), pulmonary fibrosis (n = 6), interstitial lung disease (ILD; n = 8), pulmonary hypertension (n = 6), sarcoidosis (n = 5), asthma (n = 2), cystic fibrosis (n = 1), lung cancer (n = 1), and Wegner's granulo-matosis (n = 1). Mean age in the non-COPD group was 63 years and was significantly younger than the 70 years in the COPD group ($p < 0.001$).

Non-COPD and COPD groups independently showed significant improvement with rehabilitation on all outcomes measures (Tables 1 and 2). The non-COPD group revealed better combined SGRQ impact scores (45.1 vs 36.8; $p < 0.001$) and arm curl strength scores (17.6 vs 14.2; $p < 0.001$) than the COPD group. No other group differences were observed.

Table 1. Mean pre- and post-pulmonary rehabilitation assessments in patients with non-COPD diagnosis.

Tests	Pre-Rehabilitation	Post-Rehabilitation	p value
SGRQ total score	58	50	< 0.05
SGRQ symptom score	53	45	< 0.01
SGRQ impact score	48	40	< 0.05
SGRQ activity score	76	68	< 0.01
6-minute walk	245	285	< 0.01
Chair stand strength	8	9	< 0.05
Arm curl strength	16	19	< 0.001

Table 2. Mean pre- and post-pulmonary rehabilitation assessments in patients with COPD.

Tests	Pre-Rehabilitation	Post-Rehabilitation	p-value
SGRQ total score	54	44	< 0.0001
SGRQ symptom score	58	46	< 0.0001
SGRQ impact score	43	30	< 0.0001
SGRQ activity score	73	65	< 0.0001
6-minute walk	265	311	< 0.0001
Chair stand strength	7	9	< 0.0001
Arm curl strength	12	16	< 0.0001

Discussion

Pulmonary rehabilitation improved all measured outcomes in both groups of patients. PR was beneficial to patients with all types of respiratory disease, not only those with COPD. The younger group of non-COPD patients showed higher SGRQ impact scores and arm curl strength. These differences may be related to age or severity of disease. No group differences, however, were seen in any other outcome measures.

PR aids in improving a patient's functional status and controlling their symptoms, especially dyspnea (Grade 1A evidence) and fatigue.[4] PR enlightens patients about their disease treatment options and improves their physical

capabilities and capacities. Low self-esteem and quality of life usually is present secondary to physical disability thus worsening the patient's main symptom, shortness of breath. Anxiety also worsens dyspnea. On the other hand, depression, anxiety, and dyspnea worsens the underlying physical impairment.[5] PR does not reverse the disease but reduces symptoms, disability, and mortality, resulting in a decrease in hospital stay and reduction in hospital admissions, thus lowering the cost burden on health care system.[4]

PR consists of patient assessment, exercise, dietary recommendations, and psychosocial support.[4] Training of muscles of ambulation must be implemented within the program (Grade 1 A recommendation). Benefits are observed over 6 to 12 weeks, with longer programs producing more benefits.[3] Effects may last up to 18 months in COPD patients;[6] no data are known for patients with other respiratory diseases.

Rehabilitation programs have been well developed for patients suffering from advanced COPD. It also has been used in non-COPD patients, mainly with interstitial lung diseases, cystic fibrosis, bronchiectasis, and thoracic cage abnormalities.[4] No clinical recommendation is available with regards to PR in diseases other than COPD. All of the evidence for non-COPD programs was based on expert opinion. Treatment for these patients should be individualized.[7]

Growing evidence supports the need for PR in patients with Idiopathic Pulmonary Fibrosis (IPF).[7,8] PR in restrictive lung diseases has shown promising results.[8] Foster and Thomas evaluated 32 patients with ILD, bronchiectasis, fibrothorax, thoracoplasty, and neuromuscular abnormalities and they concluded that the degree of benefit was equivalent to COPD patients.[9] PR improves activity and health-related quality of life in patients with idiopathic pulmonary fibrosis.[10] Further research is required to assess the optimal timing of PR and if there is a difference in benefit within subgroup of diseases.[11]

Limitation of the data exist with restrictive lung disease, and that is because of the heterogeneity of the pathophysiology of the diseases, thus leading to different mechanisms for exercise limitations.[2] Our study showed that PR may be beneficial not only in patients with COPD, ILD, and IPF, but also in other pulmonary diseases. Further disease specific studies should establish standard protocols and guidelines for referral to PR in non-COPD diagnosis.

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Keywords: pulmonary rehabilitation, restrictive lung disease, interstitial lung disease, chronic obstructive pulmonary disease

Acromegaly Presenting as Diabetic Ketoacidosis: Thinking Beyond Diabetes Mellitus

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Introduction

Acromegaly is an acquired disorder caused by excessive production of GH and IGF-1 and characterized by somatic disfiguration and systemic manifestations.[1] It is due to monoclonal growth hormone producing pituitary adenoma in 90% of cases. Acromegaly is rare, with an incidence of three cases per million persons per year.[2] Due to its insidious onset and slow progression the diagnosis of acromegaly typically is delayed 4-10 years after symptom onset (mean age at diagnosis 40 years).[1]

Acromegaly affects men and women equally.[1] Impaired glucose tolerance and diabetes mellitus (DM) are common in patients with acromegaly, with a prevalence of 36% and 30%, respectively.[2] Diabetic ketoacidosis (DKA) is a rare complication of acromegaly with only a few cases reported in the English medical literature.[3-15] Factors that promote ketoacidosis in acromegalic patients include infection, surgical procedures, cessation of octreotide therapy, and excessive ingestion of sugar-containing soft drinks.[7]

We present a case of a patient with no past medical history of DM who presented to the hospital for DKA and was found to have acromegaly.

Case Report

A 41-year-old Hispanic female presented with a three-month history of weakness. She also complained of a seven-day worsening of polydipsia and polyuria. Her prior medical history was significant for hypertension and hyperlipidemia. Her family history was noteworthy for type 2 DM in her mother. The patient noticed an increase in the size of her hands and feet for approximately 12 years, with an increase in shoe size from 7.5 to 9. Menstrual periods had been absent for approximately six years.

The physical examination was remarkable for a body mass index of 39 kg/m^2, blood pressure of 138/80 mmHg, heart rate of 98 beats/min, coarse facial features, and enlarged hands. Initial laboratory studies revealed a glucose of 359 mg/dl, bicarbonate of 8.4 mmol/L, ketones present in blood and urine, and an anion gap of 24. Arterial blood gas revealed pH at 7.27 with a pCO2 of 18 mmHg. Glycosylated hemoglobin (HbA1c) was 11.7 percent. There was neither laboratory nor physical evidence of infection, ischemia, or illicit drug use.

A random growth hormone (GH) level was elevated at 98.2 ng/ml (0-6) and insulin-like growth factor-1 (IGF-1) was elevated at 398 ng/ml (101-267), consistent with acromegaly. Other laboratory test results are included in Table 1.

Magnetic resonance imaging of the pituitary sella showed a mass arising from the pituitary that measured 2.1 x 1.8 cm, with bilateral cavernous sinus invasion and mass effect on the optic chiasm (Figure 1).

Table 1. Other laboratory values obtained on patient.

Laboratory Test	Value	Normal range
Thyroid-stimulating hormone (TSH)	0.32 μIU/ml	0.34 - 4.82
Free thyroxine	1.4 ng/dl	0.9 - 1.8
Morning adrenocorticotropic hormone	37.6 pg/ml	7.2 - 63.3
Morning cortisol	18.9 mcg/dl	4.3 - 22.4
Luteinizing hormone	0.2 mIU/ml	1.5 - 9.3
Follicle-stimulating hormone	2.7 mIU/ml	1.4 - 18.1
Prolactin	30 ng/ml	4.8 - 23.3

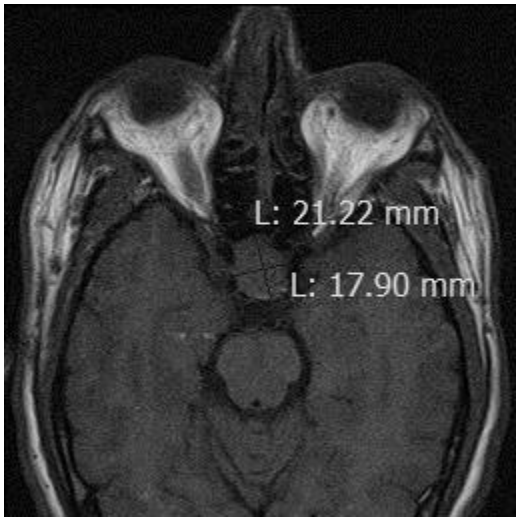

Figure 1. The pituitary sella showed a mass arising from the pituitary.

Intravenous fluids and insulin were administered for treatment of DKA. The metabolic acidosis resolved within 24 hours, and the patient was transitioned to subcutaneous insulin prior to uneventful transnasal sphenoidal resection of the mass.

Pathologic examination was consistent with a pituitary adenoma (Figure 2) with immunohistochemical stains strongly positive for synaptophysin and prolactin (Figure 3) with focal positivity for GH (Figure 4). A lesser degree of diffuse positivity was noted for follicle stimulating hormone (Figure 5). This plurihormonal immunohistochemical staining pattern (especially predominating positive staining for prolactin with only focal positive staining for GH) is well-described in some patients with pituitary adenoma and clinical acromegaly, as in this patient.[16]

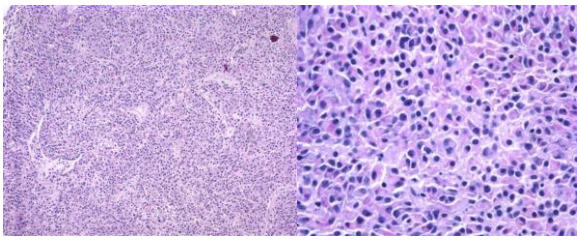

Figure 2. Pathologic examination was consistent with a pituitary adenoma.

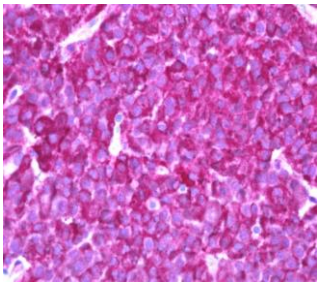

Figure 3. Immunostaining was positive for prolactin and synaptophysin.

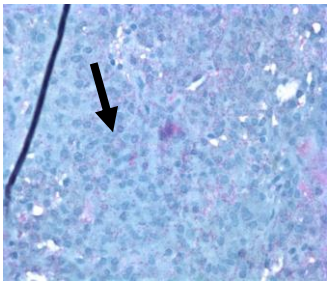

Figure 4. Immunostaining was positive for growth hormone.

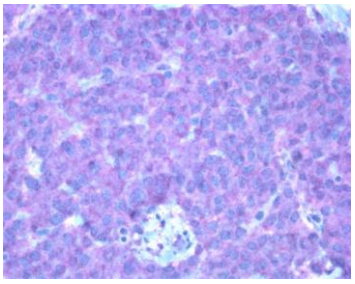

Figure 5. Immunostaining was positive for follicle stimulating hormone.

The patient was discharged on subcutaneous insulin, metformin, and lanreotide 60 mg intramuscularly monthly. At the two-month follow-up, the HbA1c level was 6.3% with a persistent elevation in the IGF-1 level at 907 ng/ml (68 - 225) and prolactin level at 50 ng/ml (4.8 - 23.3). Repeat MRI showed no evidence of residual or recurrent neoplasm. The patient was initiated on cabergoline 0.5 mg orally two times weekly for the hyperprolactinemia and lanreotide depot was increased to 90 mg intramuscularly monthly. At three months, the prolactin level had decreased to 3.2 ng/ml (4.8 - 23.3) and the IGF-1 level had decreased to 620 ng/ml (68 - 225). The lanreotide depot dose was titrated upward to achieve a normal IGF-1 level. A repeat HbA1c was 6.0% and insulin was discontinued.

Discussion

The mechanism of DKA in acromegaly is thought to be a GH and IGF-1 mediated insulin resistance in the liver and peripheral tissues leading to increased endogenous glucose production, reduced peripheral glucose uptake, and consequently hyperglycemia and β-cell glucotoxicity with reduced insulin production.[14] During fasting and other catabolic states, GH predominantly stimulates lipolysis and the release and oxidation of free fatty acids. In addition, possible direct stimulation of hepatic ketogenesis may explain diabetic ketoacidosis in some patients with acromegaly.[17] Glucagon, a counter regulatory hormone important in the pathogenesis of DKA, may be elevated in patients with acromegaly.[14]

The treatment of DM and the prevention of DKA need to be directed at decreasing GH/IGF-1 levels, either surgically or pharmacologically. Endocrine remission occurs in 50% of GH-secreting macroadenomas after surgery.[18] Patients with acromegaly and DKA showed resolution of the DKA with standard medical therapy and reduced insulin requirements and oral hypoglycemic medications after trans-sphenoidal surgery in previous case reports.[3-15] These patients required insulin for 1-20 weeks post trans-sphenoidal surgery.

Our patient improved with the standard therapy for DKA with IV and subcutaneous insulin, IV fluids, and electrolyte replacement. Subcutaneous insulin was stopped three months after surgery. Our patient had a plurihormonal adenoma producing both GH and prolactin. Cabergoline normalized her prolactin levels within three months. The elevation in her IGF-1 level required escalation of the lanreotide depot dose. The clinical course of our patient was comparable to many cases previously reported with DKA and acromegaly that underwent trans-sphenoidal pituitary adenoma resection.[3-15]

Conclusion

The definitive treatment of acromegaly is an important part of glycemic control in acromegalic patients presenting with DKA. There is need for further studies to evaluate the effect of somatostatin analogues and somatotroph tumor resection in the prevention of DKA in the long term.

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Keywords: acromegaly, diabetic ketoacidosis, diabetes mellitus

Idiopathic Acute Eosinophilic Pneumonia: An Uncommon Cause of Sudden Hypoxia

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Introduction

Pulmonary eosinophilic pneumonias include a heterogeneous group of disorders characterized by the presence of eosinophils in the lungs as detected by bronchoalveolar lavage or tissue biopsy, with or without blood eosinophilia (Tables 1 and 2).[1] Although the inflammatory infiltrate in the lungs is composed of macrophages, lymphocytes, neutrophils, and eosinophils, eosinophilia is an important marker for the diagnosis.

Idiopathic acute eosinophilic pneumonia (IAEP) is a rapidly progressive disease of healthy adults, described in 1989.[2,3] It is reported worldwide[4] and thought to be an allergic response to an environmental stimulus, sometimes associated with early cigarette smoking.[5] IAEP is a diagnosis of exclusion and should be considered in the differential of a sudden unexplained hypoxia and extensive pulmonary infiltrates.

Case Report

A 55-year-old Caucasian male presented with a seven-day history of losing ten pounds and night sweats. He had progressive shortness of air over the previous day and one-half. He was hypoxemic requiring 5-6 liters of oxygen by nasal canula and had bilateral infiltrates on chest x-ray (Figure 1) and computer tomography of the chest (Figure 2). Initial

Table 1. Classification of pulmonary eosinophilia based on clinical-radiological presentation.[1]

1) Simple pulmonary eosinophilia
2) Chronic eosinophilic pneumonia
3) Acute eosinophilic pneumonia
4) Allergic bronchopulmonary aspergillosis
5) Pulmonary eosinophilia associated with a systemic disease
   a) Churg-Strauss syndrome
   b) Hypereosinophilic syndrome

Table 2. Classification based on etiology of the forms of pulmonary eosinophilia.[1]

1) Primary or idiopathic
2) Secondary
   a) Known causes: drugs, parasites, toxic products/irradiation, fungal and mycobacterial infection
   b) Diffuse lung diseases: cryptogenic organizing pneumonia; hypersensitivity pneumonia; idiopathic pulmonary fibrosis; Langerhans cell histiocytosis; sarcoidosis
   c) Malignant diseases: leukemia, lymphoma, lung cancer, adenocarcinoma involving multiple organs, squamous carcinoma involving multiple organs
   d) Connective tissue diseases: rheumatoid arthritis, Sjögren's syndrome

laboratory work showed leucocytosis at 19,800 mcL without eosinophilia and bandemia of 16%. He had been exposed to tuberculosis in the past and tested positive on the tuberculosis skin test, however, he never had symptoms nor been treated. Active tuberculosis was ruled out. He also tested negative for atypical pneumonia including legionella, mycoplasma, and chlamydia. He also was checked for human immunodeficiency virus, vasculitis with antinuclear and antineutrophil cytoplasmic antibodies, and fungal infection including histoplasma. All tests were negative.

Sputum for gram stain and culture was positive for Staphylococcus aureus. Later, candida showed on culture which was thought to be commensal. The patient continued to be hypoxemic requiring about six liters of oxygen despite appropriate antibiotics and supportive treatment.

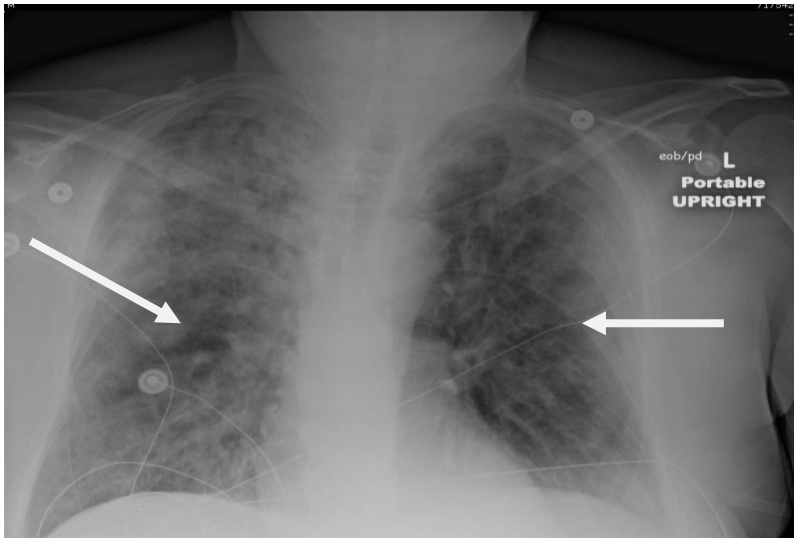

Figure 1 . Chest x-ray shows diffuse airspace consolidation.

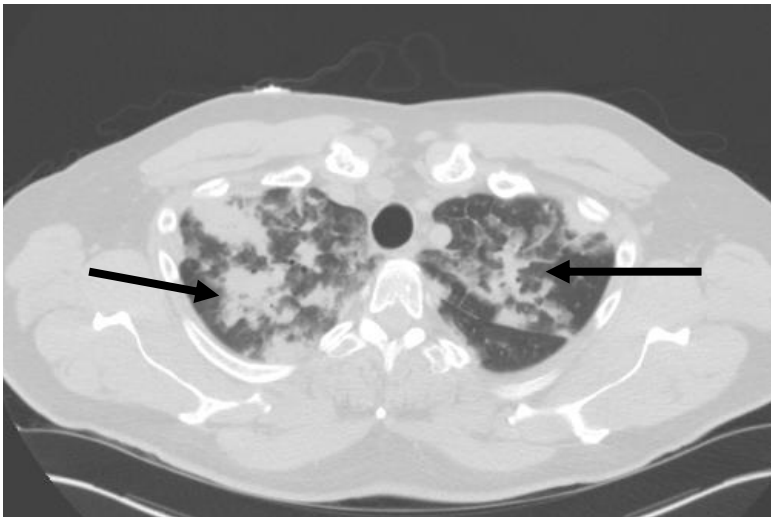

Figure 2. CT of the chest shows irregular, predominantly alveolar, infiltrate involving upper lobes bilaterally with lesser involvement of the lower lobes (not shown).

Bronchoalveolar lavage subsequently showed eosinophilia of 86%. A diagnosis of idiopathic acute eosinophilic pneumonia was made. The patient was started on IV steroid therapy as other causes for eosinophilia had been ruled out. The patient responded dramatically to steroids and was taken off oxygen in two days. He was sent home on tapering doses of steroids and antibiotics for methicillin resistant Staphylococcus aureus.

Discussion

Simple pulmonary eosinophilia is characterized by migratory pulmonary infiltrates in patients with eosinophilia and few or no pulmonary symptoms.[6,7] Pulmonary infiltrates are peripheral with a pleural base. Drugs and ascariasis are the most common causes. In one-third of cases, simple pulmonary eosinophilia is idiopathic. The prognosis is excellent. Corticosteroids are rarely necessary. Spon-taneous resolution occurs within 30 days.

Chronic eosinophilic pneumonia (CEP) is a severe disease of insidious onset with nonspecific respiratory and systemic symptoms.[8,9] Typically, CEP is idiopathic. The radiological profile is suggestive of peripheral consolidation that responds to corticosteroids, although it has a high recurrence rate. It can be secondary to drugs, parasites, and irradiation for breast cancer, or be associated with rheumatoid arthritis.[10] It has been described after childbirth[11,12] and desensitization using immunotherapy (allergy shots).[12]

The diagnosis is made on clinical criteria, a suggestive radiological profile, and the presence of peripheral eosinophilia or eosinophilia in the bronchoalveolar lavage fluid.[1] A rapid response to corticosteroids facilitates confirmation of the diagnosis. Spontaneous resolution is rare (occurring in only 10% of cases). There is a high recurrence rate after discontinuation of steroids.

Allergic bronchopulmonary aspergillosis (ABPA) is a complex hypersensitivity reaction that occurs when airways become colonized by aspergillus.[13] The following criteria are considered essential for a diagnosis of ABPA: asthma with central bronchiectasis or pulmonary infiltrates, positive skin test reactivity to aspergillus, total IgE levels greater than 1,000 U/L, and IgE or IgG against aspergillus in the blood. Based on disease activity, ABPA can be classified as having four distinct stages: remission, exacerbation, corticosteroid-dependent, and fibrotic phase.[1]

Chugg Straus Syndrome (CSS) or allergic granulomatosis and angiitis is a vasculitic disorder often characterized by sinusitis, asthma, and prominent peripheral blood eosinophilia.[14] CSS needs the following criteria for the diagnosis with confirmation of at least four being necessary: asthma, eosinophilia (greater than 1,500 cells/mm^3), paranasal sinus involvement, transient pulmonary infiltrates, mononeuropathy or poly-neuropathy, and biopsy findings of vasculitis. The disease pattern has such a distinct profile that it sometimes allows the diagnosis to be made clinically.[15] This syndrome is characterized by three phases: (1) allergic phase: presence of asthma or rhinitis, (2) eosinophilic phase: presence of severe persistent peripheral eosinophilia (greater than 1,500 cells/mm^3) for more than 6 months, and (3) vasculitic phase: presence of systemic manifestations and small vessel vasculitis, represented by the involvement of two or more extra pulmonary organs.

Hypereosinophilic syndrome (HES) is rare and typically results in death.[16] HES presents persistent eosinophilia (greater than 1,500 cells/mm^3; 30-70% of total leukocyte count) for more than six months. Organ involvement mainly includes the skin, the heart, the nervous system, and the

hematological system. The cytotoxicity of the major basic protein and eosinophil cationic protein content of eosinophils explains various instances of organ involvement in HES. The diagnosis is based on three criteria: persistent eosinophilia for at least six months or death within six months due to the signs and symptoms related to eosinophilia, eosinophilia-related involvement of at least one organ, and absence of a known cause of eosinophilia, such as drugs, parasites, malignancy, vasculitis, CEP, and CSS.[17]

Acute eosinophilic pneumonia (AEP) includes acute respiratory failure, fever, diffuse pulmonary infiltrate, and severe eosinophilia in the bronchoalveolar lavage (BAL) fluid or in lung tissue.[18,19] Histo-logical examination reveals eosinophil infiltration and edema in the alveolar spaces and interstitium, including the interlobular septa. In the lung tissues, there is a release of eosinophil chemotactic cytokines, granulocyte-macrophage col-ony-stimulating factor (GM-CSF), IL-3, IL-5, and IL-1B, all of which accumulate and are seen in the BAL fluid without an increase in the blood. This explains tissue eosinophilia without peripheral eosinophilia.

Pulmonary eosinophilia presents the greatest number of eosinophils in lung tissue. The granules containing toxic proteins explain why the tissue injury is so severe. Since the proteolytic potential of eosinophils is lower than neutrophils, the acute lung injury is reversible and there are no sequelae.[20] AEP can be caused by drugs as sertraline, BCG, minocycline, injectable progesterone, and inhaled cocaine. It also can be caused by passage of parasites through the lung, fungi, and inhalation of toxic products, but is most often idiopathic.[18]

Idiopathic acute eosinophilic pneumonia

IAEP is a treatable cause of acute hypoxic respiratory failure.[21] IAEP is a diagnosis of exclusion and consisting of an acute febrile illness of short duration (usually less than one week), hypoxemic respiratory failure, diffuse pulmonary opacities on chest radiograph, BAL eosinophilia great than 25 percent, lung biopsy evidence of eosinophilic infiltrates (acute and/or organizing diffuse alveolar damage with prominent eosinophilia as the most characteristic finding) and absence of known causes of eosinophilic pneumonia, including drugs, infections, asthma, or atopic disease. IAEP can occur at any age, even in previously healthy children, though most patients are between 20 and 40 years of age.[6,22] Men are affected approximately twice as frequently as women.[2,4,18,23]

Patients present with an acute febrile illness of less than three weeks duration, nonproductive cough and dyspnea.[23,24] Associated symptoms and signs include malaise, myalgias, night sweats, and pleuritic chest pain. Physical examination shows fever (often high) and tachypnea. Bibasilar inspiratory crackles and occasionally rhonchi on forced exhalation are heard upon auscultation of the chest.

Hypoxemic respiratory insufficiency is identified frequently at presentation and often requires mechanical ventilation.[5] Patients generally present with an initial neutrophilic leukocytosis.[5,25] In most cases, the eosinophil fraction becomes markedly elevated during the subsequent course of IAEP.[5,20,24] The erythrocyte sedimentation rate is elevated. The IgE level has been high in a majority of the patients in whom it was measured.[18,23,26] When pleural fluid is present, it may demonstrate a marked

eosinophilia with a high pH.[23] Diagnosis is based on analysis of the BAL fluid. Unlike in CEP (in which lymphocyte and neutrophil counts are normal), the severe eosinophilia in IAEP (percentage of eosinophils greater than 25%) is accompanied by about 20% lymphocytes and 15% neutrophils; whereas, in acute respiratory distress syndrome, there is a predominance of neutrophils.

At the onset of IAEP, the chest radiograph may show only subtle reticular or ground glass opacities, often with Kerley B lines.[21] Most often, bilateral diffuse mixed alveolar and reticular opacities are seen on plain chest radiographs.[2,3] Small bilateral pleural effusions are common (in up to 70 percent of patients).[5] CT findings in IAEP include ground-glass attenuation, airspace consolidation, poorly defined nodules, interlobular septal thickening, and pleural effusions. The triad of interlobular septal thickening, bronchovascular bundle thickening, and pleural effusions are most suggestive of IAEP.[27]

Lung biopsy when performed is mainly to rule out infection, especially by fungi such as aspergillus.[28] Biopsy findings of acute and organizing diffuse alveolar damage are common. Hyaline membranes and interstitial widening (due to a combination of edema, fibroblast proliferation, and inflammatory cells characteristic of the organizing phase of diffuse alveolar damage) is seen in most cases. Marked numbers of interstitial and lesser numbers of alveolar eosinophils are found. Other features include type II pneumocyte hyperplasia (55 percent of cases), interstitial lymphocytes (100 percent of cases), an organizing intraalveolar fibrinous exudate (100 percent of cases), and perivascular and intramural inflammation without necrosis (33 percent of cases). Granulomas and alveolar hemorrhage are absent.

Patients with IAEP can be treated with methylprednisolone (60-125 mg) every six hours.[4,29] Corticosteroids are the mainstay of treatment beside treating the underlying cause, if identified. Improvement occurs rapidly (1-3 days). The dose can be reduced to 40-60 mg/day and tapered over the subsequent 2-4 weeks. Although spontaneous remissions occur, most cases will be progressive if not treated. IAEP is not accompanied by multiple organ failure (as opposed to acute respiratory distress syndrome) if treated, therefore, it has a good prognosis. After treatment, there should be no relapse.

Conclusion

Idiopathic acute eosinophilic pneumonia is a treatable cause of acute hypoxic respiratory failure. It is important to recognize and treat this rare reversible non-infectious cause of pneumonia and respiratory failure, as not treating may lead to a chronic debilitating disease or death.

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Keywords: pulmonary eosinophilia, hypoxia, case report

Thyroglossal Duct Cyst Masquerading as a Thyroid Nodule

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Introduction

Thyroglossal duct cysts are the most common congenital neck masses occurring in the midline.[1] They usually present during the first two decades of life and generally are considered to be benign, with less than 1% being malignant.[2,3] They arise from the tract that the thyroid gland takes for its descent during development.[3] We present a case of a boy that presented with a left anterior neck mass ultimately found to be a thyroglossal duct cyst.

Case Report

A 10-year, 6-month-old boy presented for workup of a presumed thyroid nodule. He initially had been treated for a sinus infection and associated anterior neck lymphadenopathy, but the anterior neck enlargement did not resolve. He reported neck fullness, but no pain, and denied any increase in size of the mass over time. He denied any manifestations of hypo- or hyper-thyroidism and denied any history of radiation to the neck.

His past evaluation included negative thyroid peroxidase antibodies, negative thyroid-stimulating immunoglobulin, and a normal thyroid function panel. His family history was negative for thyroid malignancy or disease. Physical examination confirmed a firm mass in the region of the left thyroid lobe. It was non-tender and had no overlying skin changes. The trachea was not deviated and no other cervical masses were noted. The mass did not move with swallowing or with tongue protrusion. The larynx was examined by a mirror and appeared normal with mobile vocal cords and no crepitus or protruding lesion.

Ultrasonography revealed a mass with a small cystic structure suspicious for malignancy (Figure 1). Fine needle aspiration (FNA) revealed a bland thyroid epithelium with nonspecific changes. Subsequent computed tomography of the neck revealed an intrathyroidal cystic structure in the left side of the neck (Figure 2). Because of the possibility of malignancy, the patient was referred for hemi-thyroidectomy.

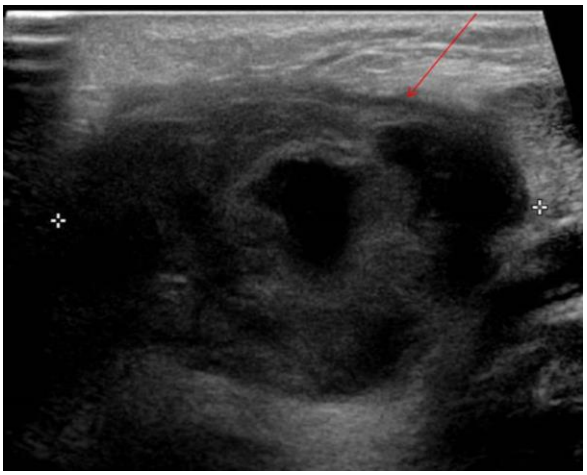

Figure 1. Ultrasound shows the left-sided neck mass.

Histology from a left hemithyroidectomy revealed a benign cystic lesion attached to thyroid tissue, with peri-thyroidal soft tissue fibrosis, chronic and xanthomatous inflammation, and follicular hyperplasia with focal atypical epithelial changes.

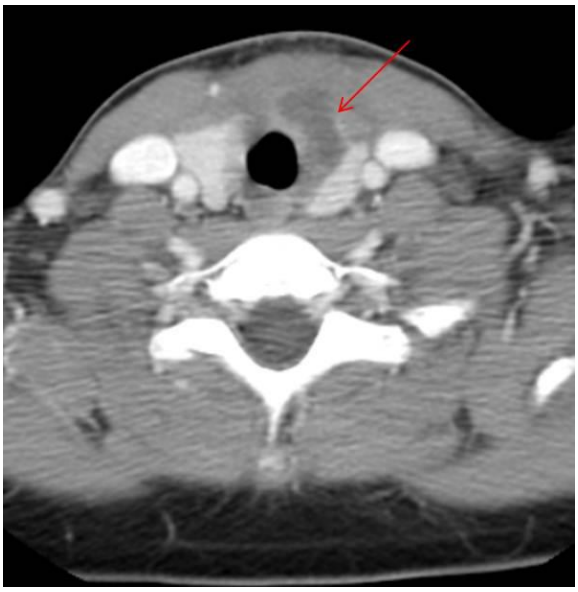

Figure 2. Computed tomography shows a large left-sided intrathyroidal cystic lesion.

Stains for CK19 and HBME-1 were negative, effectively ruling out papillary thyroid carcinoma. The cystic structure lined by bronchial epithelial cells was most consistent with a thyroglossal duct cyst.

The patient was discharged without incident and without need for thyroid hormone replacement.

Discussion

During the fourth week of fetal development, a tubular structure forms from the involution of the epithelium of the floor of the pharynx. The thyroid gland descends from the base of the tongue through this tract to reach its final destination by the seventh or eighth week of development. The tract then involutes and atrophies with the caudal portion remaining as the pyramidal lobe of the thyroid.[3,4] If the tract persists, a thyroglossal duct cyst will develop. Theories attempting to explain this phenomenon speculate either: 1) a blockage in the tract that leads to the accumulation of secretions, or 2) recurrent throat inflammation that leads to the cystic degeneration of the tract.[2]

Thyroglossal duct cysts are the most common cause of a congenital neck mass. Other items in the differential diagnosis of a painless neck mass would include ectopic thyroid tissue, a dermoid cyst, a branchial cleft cyst, a cystic hygroma, a lymph node, a lipoma, and a sebaceous cyst.[5] Thyroglossal duct cysts, though, classically present as a painless midline mass. Only one percent present lateral to the midline and only one case reported a thyroglossal duct cyst in the mediastinum.[5]

Shahin et al.[6] showed that FNA has a sensitivity of 62% and a positive predictive value of 69%, so it can help in establishing the diagnosis of a thyroglossal duct cyst in the correct clinical scenario. The cyto-pathological findings noted on FNA are not unique, though, and the clinical presentation and radiological findings must be considered in making a diagnosis.

Ultrasound is usually the first modality for investigation of neck masses in children since it is inexpensive, noninvasive, and does not expose the child to ionizing radiation or require sedation or intravenous access.[3] Usually, thyroglossal duct cysts appear as well defined, non-echoic, thin walled masses. Mixed echogenicity usually is explained by infection of the cyst,[4] though this was not the case in our patient. Surgical resection is indicated for cosmetic appearance, recurrent infections, sinus and fistula formation, and suspicion of malignancy.[7]

Clinicians, particularly endocrinologists, should consider thyroglossal duct cysts in the differential diagnosis of lateral neck masses.

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Keywords: thyroglossal duct cyst, thyroid, thyroid nodule

A Rare Combination … Of Nail Findings

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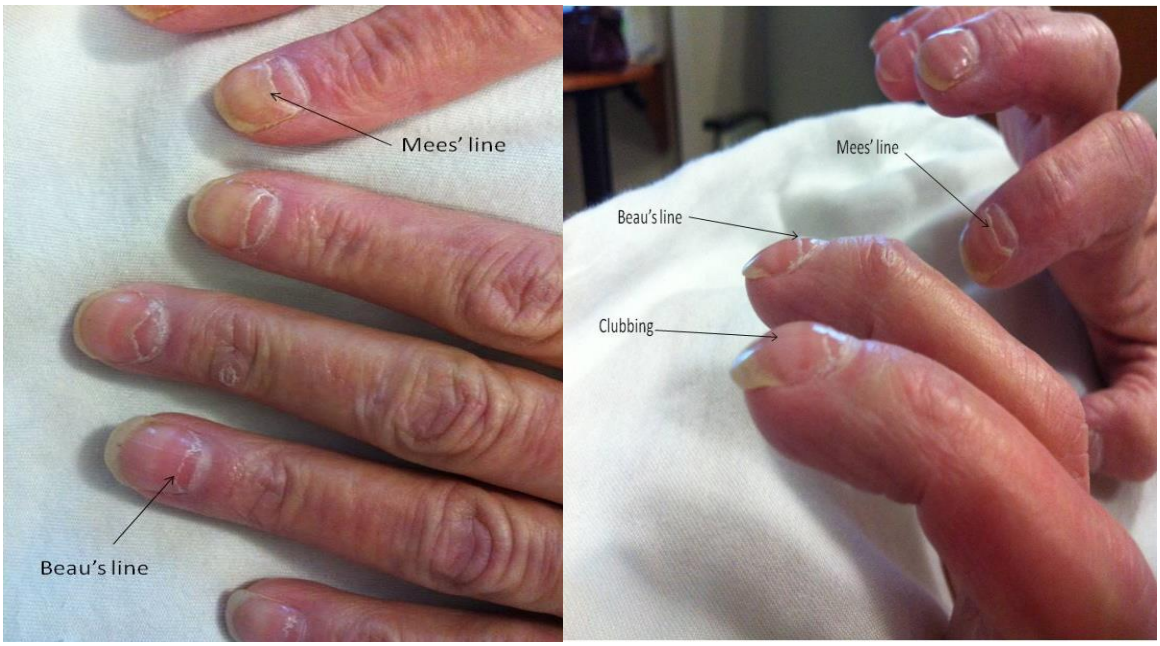

A 55-year-old female with history of chronic obstructive pulmonary disease was admitted for neutropenic fever. She was diagnosed with acute myeloid leukemia (AML) eight weeks prior to presentation and had a one-month complicated hospital course including induction chemotherapy, prolonged pancytopenia, and persistent severe infections. Her physical exam showed the nail findings above. The white bands did not fade with pressure. The patient had no other risk factors, such as Raynaud's disease or other autoimmune processes.

Discussion

Beau lines are transverse linear depressions in the nail plates.[1,2] They were first described in 1846.[1] They are usually caused by any acute illness severe enough to disrupt normal nail growth, but also can be found in Raynaud's disease, pemphigus, and trauma. Mees' lines are transverse white bands on nails.[1,2] They can occur in any acute severe illness, arsenic, or carbon monoxide poisoning, Hodgkin's disease, chemotherapy, heart failure, leprosy, and malaria.[1]

Clubbing can be found in pulmonary diseases especially with hypoxemia, including chronic obstructive pulmonary disease, malignancy, inflammatory bowel diseases, cirrhosis, congenital heart disease, endocarditis, and atrioventricular malformations.[1] The combination of Beau's lines, Mees' lines, and clubbing is a rare finding. A literature search revealed no previously known

reported cases. It is not clear to us why the combination of the three findings is rare. It is most likely under-reported. With clubbing being more prevalent and the advances in chemotherapy (more potent agents, more frequently used, and the increased incidence of cancer in general), these findings probably will become more frequent.

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Keywords: nail diseases, malformed nails, digital clubbing, case report

Rethinking Blood Transfusions: Risks, Benefits and Cost Considerations

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Introduction

Blood transfusion has been part of medical practice for hundreds of years, first pioneered in 1628.[1] Blood has been used in various clinical settings with the intended benefit of increasing oxygen delivery capacity and increasing intra-vascular blood volume. During World War II, blood donation became a national priority as American soldiers were transfused with blood products in resuscitation efforts in the field after trauma. However, a few decades later, with the new knowledge of transmission of infectious diseases, there was greater caution with blood transfusion. In the 1970's and 1980's, the emergence of human immunodeficiency viruses (HIV) and viral hepatitis led to greater public awareness about the risks of receiving a blood transfusion. Even more recently, blood transfusion has come to be viewed as an organ transplant equivalent and multiple clinical studies have indicated that greater caution and care with transfusion should be taken. While blood transfusion remains a key intervention in medical practice, its risks and benefits must be weighed carefully by the provider and patient.

The following are six clinical vignettes that highlight key concepts that are important in medical decision making regarding blood transfusions.

Blood is Safer, But Still Has Risks

Tom Jones (all patient names used in this report are fictitious) is a 55-year-old man admitted for melena and fatigue. His vital signs are stable and he reports no cardiac or pulmonary symptoms. On endoscopy, he has a gastric ulcer, which is treated appropriately and his melena ceases. On admission, the patient is found to have a hemoglobin of 8.0 g/dL and he is transfused with 1 unit of packed red blood cells. After discharge, his internist is notified by the blood bank that Mr. Jones was transfused with blood contaminated with hepatitis C that had not been detected on routine screening. The recipient was previously hepatitis negative. Whose responsibility is it to contact the patient and notify him of the contaminated transfusion? Was transfusion even indicated?

The incidence of hepatitis B, hepatitis C, and HIV have decreased in the pool of donated blood with improved screening and testing.[2] The current risk of transmission of hepatitis B infections through blood transfusion is 1 in 200,000 to 500,000; hepatitis C is 1 in 1,390,000; and HIV is 1 in 2,000,000.[3] Patients must be counseled about the infectious risks of blood prior to transfusion. If contaminated blood is transfused, then it is the responsibility of the ordering provider and the blood bank to notify the patient of this complication.

Potential non-infectious risks exist as well for the recipient of blood donation. Immunomodulation (transient adverse changes in the immune response) is a potential complication from blood transfusion.[4] The hypothesized mechanism is that transfusion of allogeneic blood may upregulate humoral immunity, down-regulate cellular immunity, and induce a proinflammatory state. This is an area of medicine under investigation, but it is

important to recognize its potential clinical effect. The increased incidence of post-operative infection after blood transfusion and possible effect on increased tumor progression in cancer patients may be due to the immunomodulatory effects of allogeneic blood transfusion.[5]

Comment. The transfusion of red blood cells was likely not indicated for Mr. Jones as he had no significant symptoms. Fatigue is not considered a serious symptom that requires transfusion for treatment. Evaluation of anemia likely would have shown iron deficiency and appropriate treatment with oral or parenteral iron would have improved the patient's symptoms without blood transfusion. In this case of possible contamination of viral hepatitis in the transfused blood, it would be the responsibility of the attending physician and the blood bank to notify the patient. It is not within the scope of this article to review appropriate transfusion thresholds for various clinical conditions. Although the topic is highly nuanced, there are multiple studies that indicate most patients can reach a hemoglobin of 7 to 8 g/dL without adverse effects.[6-8]

Inappropriate Transfusion May Lead to Adverse Outcomes

Maria Garcia is a 39-year-old woman admitted to the ICU with severe sepsis secondary to bacterial pneumonia. She is treated with appropriate antibiotics and supportive care. On admission, her hemoglobin is 11.0 g/dL, but after multiple lab draws, blood loss with central venous catheter placement, and arterial catheter placement, her hemoglobin drifts down to 7.5 g/dL by day 5 of hospitalization. At this time, she is improving from the pneumonia, sepsis is resolved, and she likely will be transferred to the floor soon. The physician caring for her is considering a blood transfusion. What potential adverse outcomes should the physician anticipate?

Blood transfusion can have potential negative clinical outcomes in a variety of clinical settings. These include increased mortality, risk for infection, and transfusion-related complications. Hébert et al.[6] published the seminal study, Transfusion Requirements in Critical Care trial (TRICC) in 1999, which called into question long-standing transfusion practices. In critically ill patients, there was no statistically significant difference in mortality between patients in the "liberal group" transfused at a trigger hemoglobin of less than 10 g/dL versus patients in the "restrictive group" transfused at a trigger of less than 7 g/dL. The liberally transfused group had significantly higher in-hospital mortality (28.1% versus 22.2%). This landmark study reframed the standard transfusion trigger to 7 g/dL for most critically ill patients, which may be lower than what many physicians used in practice.

In a large outcomes study of 1,915 patients, Engoren et al.[7] showed that in patients who underwent first time isolated coronary artery bypass surgery, mortality was higher for those who received blood transfusion. After adjustment for co-morbidities, transfusion was associated with a 70% increase in mortality (risk ratio = 1.7, CI = 1.4-2.0, $p = 0.001$). A prospective study of 15,534 patients admitted to a Level I trauma center showed that blood transfusion was a strong independent predictor of mortality ($p < 0.001$), ICU admission ($p < 0.001$), ICU length of stay (LOS; $p < 0.001$) and hospital LOS ($p < 0.001$) after controlling for severity of shock based on lactate, base deficit, shock index, and admission anemia.[9]

In a meta-analysis of 20 peer-reviewed articles, allogeneic blood transfusion had an

increased risk of post-operative bacterial infection.[10] The common odds ratio for the incidence of post-operative bacterial infection after transfusion was 3.45 (range 1.43-15.15) with 17 of 20 articles demonstrating p values less than or equal to 0.05. The odds ratio was greater in a sub-analysis of trauma patients at 5.263 (range 5.03-5.43, p = 0.005-0.0001).

Patients should be informed about the risks of non-infectious related complications as part of the consent process. Transfusion Related Acute Lung Injury (TRALI) and hemolytic transfusion reactions are major contributors to transfusion related complications.[11] TRALI is a process that mirrors Acute Respiratory Distress Syndrome, occurring after allogeneic blood transfusion. TRALI has gained recognition as a clinical phenomenon, however, it may be under-recognized and under-reported.[12] Hemolytic transfusion reactions can be due to incompatible ABO match or from minor antibodies not tested routinely. Hemolytic reactions may result in febrile illness, shock, and death.

The US Food and Drug Administration requires reporting of suspected transfusion reactions if there is an associated fatality.[10] The additional impact on patient outcomes must be considered with blood transfusion. Furthermore, the costs associated with adverse outcomes from blood transfusion add to the expenditure for each unit given.

Comment. Based on evidence from the TRICC trial,[6] blood transfusion will not improve Ms. Garcia's mortality risk at this time.

Use of Blood is Under Increasing Scrutiny

You are an involved member of the medical staff at your local hospital. The Chief of Staff approaches you one day and states that she is concerned about the high use of blood products in your institution and wants to know more about the regulatory developments in this area. She asks you to investigate and report back to the Quality Committee for the hospital. What are the latest regulatory developments? What guidelines are medical societies developing regarding blood transfusion?

In 2007, The Joint Commission (TJC) convened a stakeholders meeting to examine the evidence regarding patient blood management. A Technical Advisory Panel was convened in 2008 and drafted measures for testing. The measures were pilot tested in multiple hospitals across the country. The Technical Advisory Panel recommended the final measures with modification and these were submitted to the National Quality Forum (NQF) in November 2010.[13] Although the Patient Blood Management Performance Measures Project has not been endorsed for national use, it serves as a tool for healthcare organizations to evaluate blood utilization and the transfusion process.

As TJC examines and codifies practices in transfusion medicine, so are other medical organizations. The Society of Thoracic Surgeons (STS) and Society of Cardiovascular Anesthesiologists jointly have developed recommendations regarding blood transfusion, blood conservation, and anemia management.[14] In its outcomes research, STS measures blood use by participating hospitals and physicians. These data are provided to participating physicians with comparative analysis to their counterparts at other institutions. The AABB (formerly the American Association of Blood Banks) has published practice guidelines on red cell transfusion to guide clinicians further in the appropriate indications for transfusion.[15] The Eastern Association for Surgery of Trauma (EAST) and the American College of Critical Care Medicine (ACCM) have divided guidelines into seven categories for appropriate blood

Table 1. The Joint Commission Patient Blood Management (PBM) Performance Measures Project.[11]

PBM-01: Transfusion Consent	Patients of all ages with a signed consent who received information about the risks, benefits, and alternatives of transfusion prior to the initial transfusion of red blood cells, plasma, or platelets or the initial transfusion were deemed a medical emergency.
PBM-02: RBC Transfusion Indication	The number of transfused red blood cell (RBC) units with a pre-transfusion hemoglobin or hematocrit result and clinical indication documented from patients of all ages who received RBCs.
PBM-03: Plasma Transfusion Indication	The number of transfused plasma units (bags) with a pre-transfusion laboratory testing result and clinical indication documented from patients of all ages who received plasma.
PBM-04: Platelet Transfusion Indication	The number of transfused platelet doses with pre-transfusion platelet testing completed and clinical indication documented from patients of all ages who received platelets.
PBM-05: Blood Administration Documentation	The number of red blood cells, plasma, or platelet transfusion units/doses (bags) transfused to patients of all ages that had documentation of the following: patient identification and an order to transfuse (or Blood ID Number) confirmed prior to the initiation of transfusion, transfusion start date and time, and blood pressure, pulse, and temperature recorded at specific intervals.
PBM-06: Preoperative Anemia Screening	Select elective surgery, orthopedic, and hysterectomy patients 18 years and older with documentation of preoperative anemia screening 14-45 days before anesthesia start date.
PBM-07: Preoperative Blood Type Testing and Antibody Screening	Select elective orthopedic, cardiac, and hysterectomy surgical patients 18 years and older who had a type and screen or type and crossmatch ordered preoperatively and completed prior to anesthesia start time.

Table 2. EAST and ACCM clinical practice guideline: Red blood cell transfusion in adult trauma and critical care.[12]

A. Recommendations Regarding Indications for RBC Transfusion in the General Critically Ill Patient	1. RBC transfusion is indicated for patients with evidence of hemorrhagic shock. (Level 1) 2. RBC transfusion may be indicated for patients with evidence of acute hemorrhage and hemodynamic instability or inadequate oxygen delivery. (Level 1) 3. A "restrictive" strategy of RBC transfusion (transfuse when Hb 7 g/dL) is as effective as a "liberal" transfusion strategy (transfusion when Hb 10 g/dL) in critically ill patients with hemodynamically stable

	anemia, except possibly in patients with acute myocardial ischemia. (Level 1) 4. The use of only Hb level as a "trigger" for transfusion should be avoided. Decision for RBC transfusion should be based on an individual patient's intravascular volume status, evidence of shock, duration and extent of anemia, and cardiopulmonary physiologic parameters. (Level 2) 5. In the absence of acute hemorrhage RBC, transfusion should be given as single units. (Level 2) 6. Consider transfusion if Hb 7 g/dL in critically ill patients requiring mechanical ventilation (MV). There is no benefit of a "liberal" transfusion strategy (transfusion when Hb 10 g/dL) in critically ill patients requiring MV. (Level 2) 7. Consider transfusion if Hb 7 g/dL in resuscitated critically ill trauma patients. There is no benefit of a "liberal" transfusion strategy (transfusion when Hb 10 g/dL) in resuscitated critically ill trauma patients. (Level 2) 8. Consider transfusion if Hb 7 g/dL in critically ill patients with stable cardiac disease. There is no benefit of a "liberal" transfusion strategy (transfusion when Hb 10 g/dL) in critically ill patients with stable cardiac disease. (Level 2) 9. RBC transfusion should not be considered as an absolute method to improve tissue oxygen consumption in critically ill patients. (Level 2) 10. RBC transfusion may be beneficial in patients with acute coronary syndromes (ACS) who are anemic (Hb 8 g/dL) on hospital admission. (Level 3)
B. Recommendations Regarding RBC Transfusion in Sepsis	1. There are insufficient data to support Level recommendations on this topic. 2. The transfusion needs for each septic patient must be assessed individually since optimal transfusion triggers in sepsis patients are not known and there is no clear evidence that blood transfusion increases tissue oxygenation. (Level 2)
C. Recommendations Regarding RBC Transfusion in Patients at Risk for or With Acute Lung Injury (ALI) and ARDS (Acute Respiratory Distress Syndrome) are common clinical sequelae of massive transfusion. Prior studies have suggested that RBC	1. There are insufficient data to support Level 1 recommendations on this topic. 2. All efforts should be initiated to avoid RBC transfusion in patients at risk for ALI and ARDS after completion of resuscitation. (Level 2) 3. All efforts should be made to diagnose and report transfusion-related ALI (TRALI) to the local blood bank because it has emerged as a leading cause of

transfusion is associated with respiratory complications, including ALI and ARDS that remains even after adjusting for potential confounders.	transfusion-associated morbidity and mortality, despite under-diagnosis and under-reporting. (Level 2) 4. RBC transfusion should not be considered as a method to facilitate weaning from MV. (Level 2)
D. Recommendations Regarding RBC Transfusion in Patients With Neurologic Injury and Diseases	1. There are insufficient data to support Level 1 recommendations on this topic. 2. There is no benefit of a "liberal" transfusion strategy (transfusion when Hb 10 g/dL) in patients with moderate-to-severe traumatic brain injury. (Level 2) 3. Decisions regarding blood transfusion in patients with subarachnoid hemorrhage (SAH) must be assessed individually since optimal transfusion triggers are not known and there is no clear evidence that blood transfusion is associated with improved outcome. (Level 3)
E. Recommendations Regarding RBC Transfusion Risks	1. There are insufficient data to support Level 1 recommendations on this topic. 2. RBC transfusion is associated with increased nosocomial infection (wound infection, pneumonia, sepsis) rates independent of other factors. (Level 2) 3. RBC transfusion is an independent risk factor for multiple organ failure and systemic inflammatory response syndrome. *(*Level 2) 4. There is no definitive evidence that prestorage leukocyte depletion of RBC transfusion reduces complication rates, but some studies have shown a reduction in infectious complications. (Level 2) 5. RBC transfusions are independently associated with longer ICU and hospital length of stay, increased complications, and increased mortality. (Level 2) 6. There is a relationship between transfusion and ALI and ARDS. (Level 2)
F. Recommendations Regarding Alternatives to RBC Transfusion	1. There are insufficient data to support Level 1 recommendations on this topic. 2. Recombinant human erythropoietin (rHuEpo) administration improves reticulocytosis and hematocrit and may decrease overall transfusion requirements. (Level 2) 3. Hemoglobin-based oxygen carriers (HBOCs) are undergoing investigation for use in critically ill and injured patients but are not yet approved for use in the United States. (Level 2)
G. Recommendations Regarding Strategies to Reduce RBC Transfusion	1. There are insufficient data to support Level 1 recommendations on this topic. 2. The use of low-volume adult or pediatric blood

	sampling tubes is associated with a reduction in phlebotomy volumes and a reduction in blood transfusion. (Level 2) 3. The use of blood conservation devices for reinfusion of waste blood with diagnostic sampling is associated with a reduction in phlebotomy volume. (Level 2) 4. Intraoperative and postoperative blood salvage and alternative methods for decreasing transfusion may lead to a significant reduction in allogeneic blood usage. (Level 2) 5. Reduction in diagnostic laboratory testing is associated with a reduction in phlebotomy volumes and a reduction in blood transfusion. (Level 2)

transfusion in surgical and critical care settings.[16] These are a few examples of the efforts of American medical societies to define when blood transfusions may be appropriate.

Blood is Costly

The Chief of Staff thanks you at the next Quality Committee meeting for your excellent report. During the meeting, she mentions that the expenditures for blood bank seem to be increasing each year and with cutbacks in funding the hospital needs to "reign in budgets". What are the costs associated with blood transfusion? What impact does this have on the health system in the United States?

Recent studies demonstrated that the total cost of administration of red blood cells is higher than the acquisition costs. Shander et al. showed that acquisition cost alone of RBCs ranged from $150-$248 per unit.[17] After accounting for direct and indirect costs of administration, total costs per unit of blood ranged from $522-$1183. Costs for the two US hospitals were $726-$1183 per unit of blood given. Using these results and Department of Health and Human Services statistics for blood transfusion, the estimated acquisition costs for hospitals per year is more than $3 billion.[14] Total transfusion costs are between $10.2 and $15.4 billion. These studies do not take into account other potential costs such as lost productivity of healthcare workers (as they provide additional care to patients receiving a blood transfusion) and management of adverse transfusion outcomes.

Perioperative Anemia is Best Treated Proactively, Not Reactively

Raj Sharma is a 69-year-old man from your community who is to undergo coronary artery bypass surgery in four weeks. On pre-operative screening, he has a hemoglobin of 8.5 g/dL. He has iron deficiency anemia. He is referred to a gastroenterologist for evaluation and colonoscopy. What interventions would be indicated to treat his anemia? Will treating his anemia change his risk for transfusion peri-operatively?

The prevalence of anemia in the pre-operative surgical patient may be up to 76%, depending on the type of surgery and other medical comorbidities.[18] This patient population may benefit significantly from intervention to correct anemia before further blood loss is incurred. A British medical society has adopted guidelines that evaluation and treatment of anemia before surgery should be requisite.[19]

In non-cardiac surgery, pre-operative anemia is an independent predictor of post-operative mortality.[20,21] The lower the pre-operative hemoglobin is, the higher the mortality risk. In orthopedic surgery, pre-operative anemia confers increased risk for peri-operative blood transfusion.[22,23]

Treatment with preoperative intravenous iron is effective in increasing hemoglobin in orthopedic patients.[24,25] Patients who received pre-operative epoetin alfa then underwent large joint arthroplasty (hip or knee) showed improvement in perioperative hemoglobin and decreased risk for blood transfusion.[26-28] Erythropoietin use decreased exposure to perioperative allogeneic transfusion in orthopedic and cardiac surgery.[29] Oral iron supplementation for at least two weeks prior to colorectal cancer surgery increases hemoglobin values in anemic patients and reduces the need for intraoperative transfusion.[30]

Pre-operative anemia is a significant risk factor for worsened outcomes in the peri-operative setting. There may be several reasons that it is not treated more aggressively: (1) Medical providers have become "immune" to the presence of anemia in patients. Anemia is seen so commonly that many providers may ignore a low hemoglobin of 8 g/dL and explain that "it could be worse". However, the converse argument should be made that "it could be better". (2) Providers may not want to take time to address the problem proactively and instead take the reactive approach of giving a blood transfusion if the hemoglobin declines sharply after surgery. (3) Many providers may be unaware of alternative approaches that exist and the evidence for using them.

Comment. In the case of Mr. Sharma, administration of parenteral iron 4-6 weeks prior to surgery to correct his iron deficiency is indicated. Oral iron may be insufficient to correct his iron deficiency and consequent anemia in time for surgery. Intravenous iron is much safer in its current preparations than compared to previous preparations. It can be given on an outpatient basis in an infusion center. Intravenous iron, when prescribed for the indication of iron deficiency anemia, often does not require insurance pre-authorization.

Patient Blood Management (PBM): Applying it to your Practice

Janet Smith is a 55-year-old woman who is a nurse in your practice. She needs to have a total hip arthroplasty for a long-standing arthritis and related debility. She is well-read and knows that there are risks with blood transfusion and she would like to avoid this if at all possible. She does not want to risk being exposed to hepatitis C like Mr. Jones. What interventions can be offered to her to reduce her risk for peri-operative transfusion?

Blood transfusion has significant risks associated with its use. Clearly, there are appropriate circumstances where it is indicated. However, medical providers need to be more judicious in deciding when to transfuse. In a 2011 systematic review, Wilkinson found that gaps in the medical evidence and poor methodology of trials, particularly in the past, did not provide a strong evidence base for the use of red blood cell transfusions.[31]

PBM is the application of evidence-based concepts designed to maintain hemoglobin concentration, minimize blood loss, and optimize hematopoiesis. Pragmatically this means: (1) treating anemia proactively, (2) delaying surgical or invasive interventions until anemia can be corrected, (3) utilizing mechanical and medical interventions to minimize bleeding and blood loss at the time of surgery, (4) using blood products with an evidence-

based approach, (5) optimizing physiologic tolerance of anemia.[32] This requires a shift in mindset of the provider from the old approach of "give blood when the patient needs it" to the new approach of "optimize the patient and then only give blood once other measures have been taken".

PBM programs are being formalized in many hospitals across the country. The individual components have been shown to be effective in multiple clinical settings. A comprehensive PBM program in cardiac surgery was effective at reducing blood transfusion rates compared to hospitals without such a program.[33] Furthermore, safety was demonstrated in the PBM approach with comparatively fewer deaths and reduced complications.

Comment**.** Screening for anemia prior to surgery is indicated. Timely treatment of anemia is key to reducing Ms. Smith's risk for transfusion. Some patients may ask about pre-operative autologous donation (PAD), which has been shown to have mixed outcomes. Discussion of PAD is not within the scope of this article and should only be considered in the peri-operative setting if other blood management strategies have failed.

Conclusions

While the safety of blood products has improved in regards to quality of the product, there are significant clinical concerns regarding transfusion of allogeneic blood. Providers need to understand the risks and benefits of transfusion and counsel patients accordingly. When possible, a proactive approach to evaluating and treating anemia should be taken. Patient Blood Management is a comprehensive approach to treating anemia and reducing unnecessary blood transfusions.

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