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Does Your Pediatric Patient Have Pneumonia?

ABSTRACT & COMMENTARY

Source: Rothrock SG, et al. Do published guidelines predict pneumonia in children presenting to an urban ED? *Pediatr Emerg Care* 2001;17:240-243.

It is difficult to predict the presence of pneumonia in sick children with respiratory symptoms in the emergency department (ED). While numerous criteria for signs and symptoms abound in the literature, controversy remains about when to obtain a chest x-ray (CXR) for definitive diagnosis. To assess the validity of recently published guidelines, Rothrock and colleagues, at an urban ED in Orlando, evaluated evidence-based criteria generated by a Canadian task force. These experts suggested in 1997 that the absence of a four-fold cluster of tachypnea, respiratory distress, crackles, and diminished breath sounds accurately excluded pneumonia.

Rothrock studied 329 children younger than age 5. All had CXRs for possible pneumonia after clinical examination by pediatric ED physicians, who completed a computerized questionnaire for each case. Patients were excluded in instances of trauma, foreign body ingestion, or submersion. Board certified radiologists interpreted all radiographs, defining pneumonia as "pneumonia or an infiltrate."

In these cases, 130 of 329 patients (40%) had fever, 104 (32%) had cough, and 73 (23%) had respiratory distress (grunting, gasping, or retractions). Tachypnea was categorized according to World Health Organization criteria: more than 60 breaths per minute (bpm) for neonates younger than 1 month old, more than 50 bpm for infants 2-12 months old, and more than 40 bpm for children 1-5 years old. Preliminary diagnoses, prior to viewing radiographs, included upper respiratory infection (48%), pneumonia (38%), asthma (6%), sepsis/meningitis (2%), and aspiration (1%). Upon radiographic evaluation, 67 of 329 children (20%) were diagnosed with pneumonia. The authors applied the Canadian guidelines to

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the Orlando ED children, calculating a sensitivity of 45% (95% CI, 33-58%), specificity of 66% (95% CI, 60-72%), positive predictive value of 25% (95% CI, 18-34%), and negative predictive value of 82% (95% CI, 77-87%).[1] The single clinical finding most predictive of pneumonia was respiratory distress, with sensitivity and specificity of 25% and 18%, respectively. The authors conclude that the published criteria from the 1997 Canadian task force are insufficiently sensitive for detection of pneumonia in infants and young children.

COMMENTARY BY MICHAEL FELZ, MD

The sensitivity of less than 50% and positive predictive value of only 25% do not support the widespread application of these criteria, based on this analysis of more than 300 children in Orlando. The authors are quick to point out prior studies of predictive symptoms and signs for pneumonia in which data are equally conflicting. They further cite the general lack of consensus on when to perform a CXR in ill children, despite studies touting certain symptoms singly or in combination. As an example, the best predictor of pneumonia in the current study was respiratory distress, although the sensitivity of 25% is hardly persuasive.

I reviewed the paper from the Canadian task force.[1] These experts in pediatric infectious disease and microbiology held six consensus meetings and examined published evidence from developed countries only. They analyzed five studies of a total of 1100 children, 201 of whom had radiographic pneumonia. Sensitivity and specificity were calculated for four clinical findings: respiratory distress, tachypnea, crackles, and decreased breath sounds. Absence of all four excluded pneumonia with high specificity, but the authors stated "no finding in itself can be used to diagnose or rule out pneumonia." These guidelines, then, suggest when not to order a CXR, not when to do so.

So what are busy practitioners to conclude? It seems to me that a child presenting with fever and respiratory symptoms needs a CXR if tachypnea (age appropriate), retractions, crackles, or reduced breath sounds are documented. Conversely, the absence of this four-fold cluster of clinical manifestations almost would appear to eliminate the need for a chest film, based on the 82% negative predictive value derived from the Orlando study. My colleagues in our pediatric ED further reminded me that an oxygen saturation of less than 96% is an indication for a CXR in an ill child with respiratory symptoms.

Immunization against *Hemophilus influenzae* and *Streptococcus pneumoniae* has shifted the etiologic agents for pediatric pneumonia to favor viral pathogens in the majority of cases. I suspect that revised guidelines are forthcoming that will incorporate criteria more specific for infection by respiratory syncytial virus (RSV), parainfluenza, influenza, rhinovirus, and adenovirus. In the meantime, clinicians would be wise to heed age-specific definitions of tachypnea, and be vigilant for signs of respiratory distress. I will welcome more definitive decision rules for pediatric pneumonia diagnosis and indications for CXRs once upcoming prospective studies are completed. ❖

Reference

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A Device for the Difficult Airway

ABSTRACT & COMMENTARY

Source: Ferson AZ. Use of the intubating LMA-Fastrach™ in 254 patients with difficult-to-manage airways. *Anesthesiology* 2001;95:175-181.

The authors of this retrospective case series reviewed the records of patients with difficult airways in whom the LMA-Fastrach™ was used electively or emergently at four institutions from October 1997 through October 2000. All patients had at least one of the following characteristics: 1) a failed intubation associated with a grade 4 laryngoscopic view; 2) an immobilized cervical spine; 3) a distorted airway secondary to tumor, surgery, or radiation therapy; or 4) the presence of a steriotactic head frame. Both blind insertion and fiberoptic-guided insertion were performed. In each case the number of insertion and intubation attempts were recorded.

The LMA-Fastrach™ was used in 257 procedures performed in 254 patients with difficult airways. Two hundred patients (78%) were under general anesthesia, 51 patients (20%) were pretreated with topical anesthesia, and six unconscious patients (2%) received no pretreatment. The overall success rates for blind (n = 200) and fiberoptic-guided (n = 57) intubation through the LMA-Fastrach were 96.5% and 100%, respectively. The number of attempts required for blind intubation were: one in 151 cases (76%), two in 28 cases (14%), three in seven cases (3%), four in five cases (3%) and five in two cases (1%). Fiberoptic guided intubation had a 100% success rate on the first attempt.

In the subset of patients with cervical immobilization (n = 70), blind insertion of the LMA-Fastrach™ was successful in 97% of cases; in two cases, fiberoptic insertion was successful on the first attempt. In the subset of patients with distorted upper airways (n = 50), fiberoptic insertion of the LMA-Fastrach™ was successful on the first attempt in 100% of cases.

COMMENTARY BY MICHAEL A. GIBBS, MD, FACEP

The laryngeal mask airway (LMA) is one of several airway rescue options recommended by the American Society of Anesthesiology's Difficult Airway Algorithm.[1] The LMA-Fastrach™ offers a significant advantage over the standard LMA in that insertion of a cuffed tube into the trachea is possible. In this, the largest published case-series to date, the device was highly successful in patients with difficult airways. While retrospective and uncontrolled, the results are a strong endorsement for the device. Emergency physicians should invest the time required to become familiar and comfortable with the LMA-Fastrach™, as well as other airway rescue devices. We don't need them too often, but when we do there is absolutely no room for error. ❖

Reference

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Vasooclusive Crisis of Sickle Cell Anemia: A New Therapy

ABSTRACT & COMMENTARY

Source: Orringer EP, et al. Purified poloxamer 188 for treatment of acute vaso-occlusive crisis of sickle cell disease: A randomized controlled trial. *JAMA* 2001;286:2099-2106.

Purified poloxamer 188 (pp188) is a nonionic surfactant with properties that are thought to improve microvascular flow by reducing whole blood viscosity, erythrocyte aggregation, and adhesion to the vascular endothelium. The investigators of this randomized, double-blind, placebo-controlled trial hypothesized that PP188 would decrease the duration of acute, painful episodes in patients with sickle cell disease (SCD). At 40 medical centers, 250 patients (adults and children) with SCD who had a painful episode severe enough to require hospitalization and narcotic analgesics were enrolled in the study. Patients were randomly assigned to receive an intravenous infusion of PP188, 100 mg/kg for one hour followed by 30 mg/kg/hour for 47 hours, or a matching volume of saline placebo.

The mean duration of the painful episodes was 141.4 hours in the placebo group and 132.6 hours in the PP188 group, a nine-hour reduction (P = 0.04). Subset analyses indicated an even more pronounced PP188 effect in children ages 15 years or younger (21 hours; P = 0.01) and in patients who were receiving hydroxyurea (16 hours, P = 0.02). Secondary efficacy end points (time to discharge, pain, total analgesic use, and pharmacoeconomic costs) statistically were not different between the two treatment groups. There were no differences between the two groups in the overall inci-

dence of adverse events, including increased risk of bleeding during PP188 treatment.

COMMENTARY BY STEPHANIE B. ABBUHL, MD, FACEP

This large-scale, well-executed study found a decrease in the duration of SCD painful episodes in patients treated with PP188 when compared to those who received placebo. Unfortunately, the difference, while statistically significant, was disappointingly modest (a 6.4% reduction; 5.9 vs 5.5 days) and may not be of clinical significance. The results for children and those patients receiving concurrent hydroxyurea were much more promising and deserve further investigation.

For the purposes of this study, the duration of a painful crisis was defined as the time from randomization to crisis resolution. It is interesting to note that the mean (SD) time from onset of crisis to randomization was 2.25 days (2.14) in the PP188 group and 1.87 days (1.84) in the placebo group (P = 0.12). After randomization, it took another approximately 2.2 hours for patients to receive the study drug infusion. The patients had already experienced two full days of pain at the time of initiation of study drug. Since established pain is more difficult to suppress than acute pain,[1] it is possible that any physiologic improvement in microvascular blood flow might have been overshadowed by the "up-regulated" pain cycle.[2] It also is possible that tissue ischemia and inflammation were so entrenched that the potential benefit from PP188 could not be optimized. There was no subset analysis based on the duration of pain before receiving the study drug.

Until there is more information from additional studies, it is unlikely that PP188 will be one of the therapies we use in the ED in the near future for acute vasoocclusive crisis. We must continue to be vigilant with sickle cell patients, relying on rapid pain assessment based on the patient's report and prompt delivery of pain medication based on repeated pain assessments. ❖

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2. Ducharme J. Acute pain and pain control: State of the art. *Ann Emerg Med* 2000;35:592-603.

Droperidol vs. Prochlorperazine for Benign Headache

ABSTRACT & COMMENTARY

Source: Miner JR, et al. Droperidol vs. prochlorperazine for benign headaches in the emergency department. *Acad Emerg Med* 2001;8:873-879.

Many emergency physicians merely classify the undifferentiated headache, a common emergency department (ED) complaint, as either serious or benign, with the great majority being considered benign. This study compared the efficacy of droperidol vs. prochlorperazine in the treatment of ED patients clinically diagnosed with benign headaches.

This was a prospective, single-blind trial performed in a busy, urban ED. A convenience sample of consenting patients ages 18-60 years were enrolled if they had a "benign" headache as defined by the examining physician, and if the physician planned to treat the headache with either of the two medications. These patients were to be without an identifiable etiology of their headache from history, physical, laboratory results, or imaging studies. Patients not deemed to have undifferentiated benign headaches included, but were not limited to, those diagnosed with traumatic headaches, subarachnoid or intracranial hemorrhage, meningitis, cranial tumor, sinusitis, dental pathology, temporomandibular joint dysfunction, glaucoma, or systemic infection.

Enrolled patients were randomized to receive either droperidol 5 mg IM or 2.5 mg IV, or prochlorperazine 10 mg either IM or IV. The route of administration was decided by the treating physician prior to randomization. Prior to receiving medication, and again at 30 and 60 minutes, patients were asked to complete a 100 mm visual analog scale (VAS) ranging from no pain (0) to most severe pain (100). Physicians were required to record side effects of the medications and whether further medication was required. Side effects were classified as dyskinesia, akathisia, hypotension, arrhythmia, decreased level of consciousness, or other. Patients were contacted by telephone 24 hours after the ED visit to assess for rebound headaches or delayed medication side effects.

One hundred sixty-eight patients completed the study, with 82 receiving droperidol and 86 receiving prochlorperazine. Forty-nine (60%) of the patients in the droperidol arm received their medication IM, and 57 (66%) of

the patients in the prochlorperazine arm received their medication IM. The two groups were not statistically different in initial VAS score, gender, age, home analgesic use prior to presentation, percentage of patients with previously diagnosed migraine headaches, or rate of IM medication administration.

Sixty minutes after medication administration, the mean decrease in VAS score was 81% (from 79.8 mm to 16.3 mm) for droperidol and 70% (from 74.3 mm to 28.9 mm) for prochlorperazine (P = 0.001). At 60 minutes, 90% of the patients receiving droperidol and 69% of the patients receiving prochlorperazine had at least a 50% reduction in their VAS scores (P = 0.017). No difference between IM dosing and IV dosing was detected. Side effects, including dystonia, akathisia, and decreased level of consciousness, were seen in 15% of patients receiving droperidol and 10% of patients receiving prochlorperazine. Of the 13 patients with side effects in the droperidol group, one had dystonia, five had akathisia, and seven had decreased level of consciousness requiring between 95 minutes and 4.5 hours of observation prior to discharge. Of the eight patients with side effects in the prochlorperazine group, seven had akathisia and one had decreased level of consciousness. On phone follow-up, similar numbers of patients had rebound headaches.

The authors conclude that droperidol is more effective than prochlorperazine in relieving pain associated with benign headaches. They report that the study was not powered or designed to draw any conclusions regarding adverse effects or routes of administration, and believe future studies are warranted.

COMMENTARY BY JACOB W. UFBERG, MD

This is a well-designed study which shows that droperidol is statistically superior to prochlorperazine for relieving the pain associated with benign headaches. However, the use of the arbitrary cutoff of 50% reduction in VAS score inflates the numerical superiority of droperidol from a difference of 81% vs. 70% decrease in absolute VAS score to a much more impressive difference (90% vs 69%) in number of patients achieving this artificial benchmark.

Additionally, the final VAS scores at 60 minutes were 16.3 mm for the droperidol group and 28.9 mm for the prochlorperazine group. While this difference is statistically significant, the clinical significance of this difference is unclear. Very few studies have attempted to quantify the minimum clinically significant VAS difference. One prior study by Todd and Funk examined physician-assigned VAS scores (rather than patient-assigned, as in this study), and estimated that changes of less than 18 mm may have little clinical importance.

In conclusion, it appears that droperidol offers a statistical and likely (but not definite) clinical advantage in the treatment of benign headaches in the ED. We must remain aware, however, of the increased rate of sedation among patients receiving droperidol and the possibility of prolonged length of stay when using this medication. ❖

Special Feature

Scapholunate Dissociation

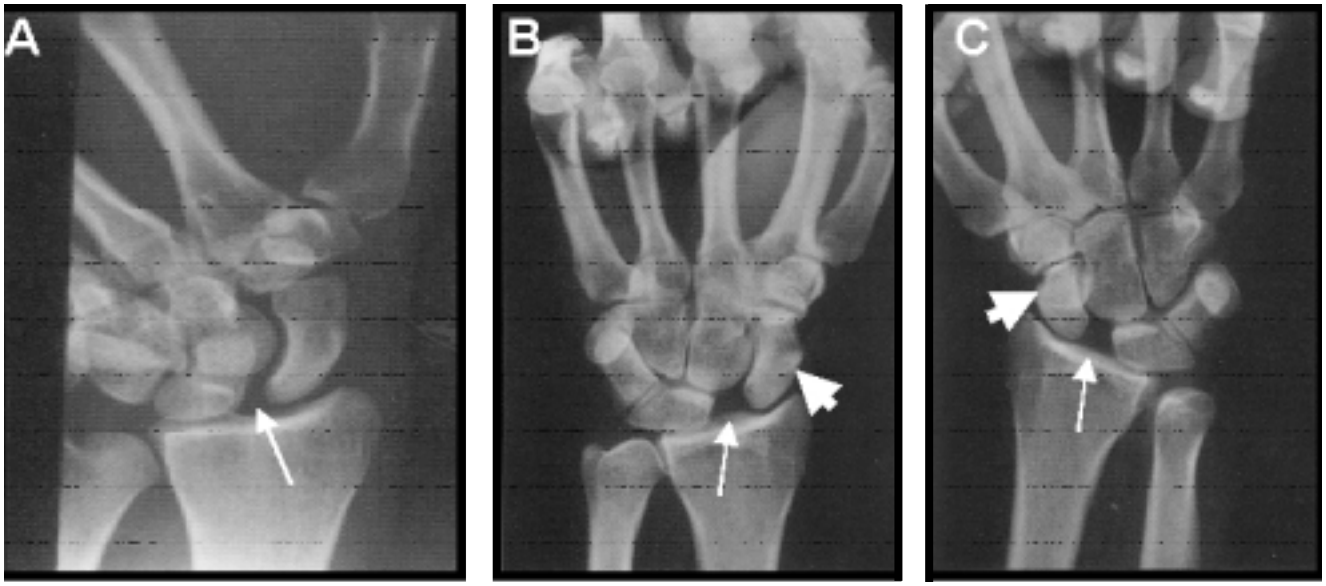
By William J. Brady, MD

Scapholunate dissociation rapidly is becoming the most common form of carpal instability. Despite the literature supporting the importance of early diagnosis and treatment, this problem is not often recognized on initial presentation. With the growing awareness of the problem of occult scaphoid fracture, scapholunate dissociation seems to have replaced this carpal fracture as the most commonly misdiagnosed cause of the wrist sprain diagnosis.[1,2] If recognized initially and treated appropriately, this condition has a very good prognosis in terms of recovery of both motion and function. If treated late, however, chronic disability is inevitable.[3] On initial presentation, it is vitally important to realize that these patients do not necessarily have tenderness in the anatomic snuffbox and that their symptoms lessen rapidly. As such, if the diagnosis is not made or suspected in the emergency department (ED), the patient may never make it to the orthopedist until the condition becomes chronic and the outcome much less favorable.

These injuries occur with hyperextension and/or the FOOSH (fall-on-an-outstretched-hand) mechanism.[4] Subjectively, the complaints of pain vary from minimal to excruciating. Patients often will complain of weakness, and possibly a click or clunk with gripping activity. Additionally, the patient who presents to the ED with complaints of a growing dorsal wrist mass should be evaluated with radiographs, as a dorsal ganglion cyst may be associated with the chronic form of this condition. The most important portion of the physical examination, as with all wrist injuries, is exact localization of the point of maximal tenderness. These patients will localize their maximum tenderness to the scapholunate junction, which is palpable just distal to Lister's tubercle on the dorsal aspect of the wrist. They may or may not also have snuffbox or tubercle tenderness. Wrist motion is very variable and may be extremely limited

Figure

Scapholunate dissociation



A. The Terry Thomas sign *(arrow)*, a widening of the scapholunate interval greater than 2 mm.

B. The Terry Thomas sign *(small arrow)*, a widening of the scapholunate interval greater than 2 mm, as well as a foreshortening of the scaphoid *(large arrow)*.

C. The Terry Thomas sign *(small arrow)*, a widening of the scapholunate interval greater than 2 mm, foreshortening of the scaphoid, and cortical ring sign *(large arrow)*.

or nearly normal. The amount of swelling also is very variable.

The radiographic findings in this condition are numerous and readily visible on three films. The supinated AP, clenched fist AP, and lateral views will demonstrate the following characteristic findings: 1) widening of the scapholunate gap to greater than 2 mm (Terry Thomas sign) is an indicator of scapholunate dissociation, which is best visualized on a supinated AP or clenched fist AP view, as seen in Figure 1;[5] 2) foreshortened appearance of the scaphoid in palmar flexed position on the AP view; 3) cortical ring sign seen in the AP view, representing a double density shadow produced by the axial projection of the abnormally oriented scaphoid upon itself; 4) on the lateral view, the scaphoid lies more perpendicular to the axis of the radius rather than at its usual angle of 45-60 degrees; 5) trapezoidal lunate as seen on the AP view is produced by a triangular shape of the lunate as it overlaps the capitate, an indicator of the rotation of the lunate into an extended position; 6) Taleisnik's "V" sign is produced by palmar flexion of the scaphoid, leading to a more acute angle between the distal radius and scaphoid forming a sharper V-shaped pattern rather than the broad C-shaped arc seen in the normal wrist.

Standard radiographs, however, may be entirely normal. When a scapholunate ligament injury is suspected clinically, additional stress views may be obtained—ulnar deviation with a clenched fist (the clenched fist AP view) will accentuate widening of the scapholunate joint.[6]

Treatment for this disorder is relatively simple in the ED. A thumb spica splint is applied acutely and referral is made to an orthopedic or hand surgeon for operative repair. This referral is not emergent, though the patient should be seen within 10 days to facilitate early repair. The real key to ensuring appropriate treatment for this potentially disabling condition is to have a high index of suspicion and to make the diagnosis acutely so that early repair is possible. ❖

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CME Objectives

To help physicians:

- Summarize the most recent significant emergency medicine-related studies;
- Discuss up-to-date information on all aspects of emergency medicine, including new drugs, techniques, equipment, trials, studies, books, teaching aids, and other information pertinent to emergency department care; and
- Evaluate the credibility of published data and recommendations.

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CME Questions

7. The best clinical predictor of radiographically confirmed pneumonia in an ill child younger than age 5 is:
a. cough.
b. respiratory distress.
c. purulent nasal discharge.
d. tachycardia.

8. The laryngeal mask airway (LMA) Fastrach™ device:
a. has an unacceptable failure rate when inserted blindly.
b. should be inserted only under direct visualization.
c. is useful for selective mainstem intubation in cases of pulmonary hemorrhage.
d. can be inserted blindly or fiberoptically with a high success rate.

9. Regarding the study of purified poloxamer 188 (PP188) in the treatment of acute vasoocclusive crisis of sickle cell disease, all of the following are true *except:*
a. PP188 is a nonionic surfactant with properties that are thought to improve microvascular blood flow.
b. PP188 was associated with a modest reduction in the duration of painful crises when compared to placebo.
c. PP188 was associated with a more impressive reduction in the duration of painful crises when compared to placebo in two subgoups: children younger than 15 years of age and patients receiving hydroxyurea.
d. PP188 was administered to sickle cell patients in the first 12 hours of their painful crises.

10. Droperidol outperformed prochlorperazine for treating:
a. pain associated with benign, undifferentiated headache.
b. pain associated with pseudotumor cerebri.
c. nausea associated with pseudotumor cerebri.
d. nausea associated with benign, undifferentiated headache.

11. Patients with scapholunate dissociation:
a. always present with severe pain.
b. almost always have normal radiographs.
c. frequently suffer chronic disability if undiagnosed.
d. must undergo emergent operative repair.

12. The Terry Thomas sign, seen in scapholunate dissociation, is:
a. a radiodense line through the waist of the scaphoid.
b. a widening (> 2 mm) of the distance between the scaphoid and the lunate.
c. not seen in elderly women.
d. the clockwise rotation of the lunate on the trapezoid.

LBBB — and What Else Unusual?

By Ken Grauer, MD

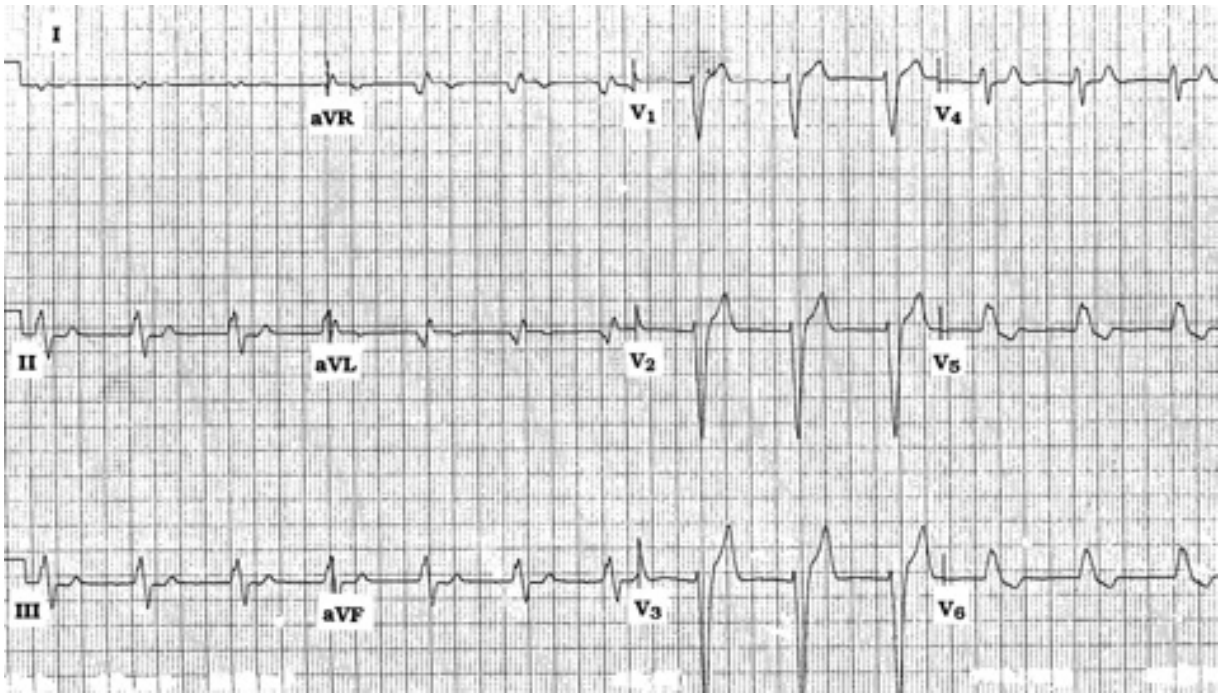

Figure. ECG obtained from a 92-year-old man with coronary disease and renal failure.

Clinical Scenario: The ECG shown in the Figure was obtained from a 92-year-old man with known left bundle-branch block (LBBB), coronary disease, and renal failure. Can you identify at least three unusual features about this ECG and the LBBB pattern it represents? What clinical conditions do these atypical features suggest?

Interpretation: The ventricular rhythm is regular at a rate of 80/minute. The QRS complex is obviously widened, and generally resembles the pattern of LBBB. However, sinus P waves are nowhere to be found on this tracing. In view of the history (LBBB pattern on previous ECGs plus known coronary disease and renal failure), the cardiac rhythm is uncertain.

Features about the ECG pattern shown in the Figure that are distinctly atypical for LBBB include the following: 1) lack of a monophasic, upright complex in lead I; 2) the presence of a Q wave and ever-so-subtle ST elevation, and T wave inversion in lead aVL; and 3) the appearance of T wave peaking (albeit with admittedly small T wave amplitude) in each of the inferior leads and in lead V_4. Several possibilities may account for these unusual findings, all of which require clinical correlation, comparison with prior ECGs, and laboratory assessment for confirmation. Unfortunately, old tracings were not available on this patient. Serum creatinine was elevated, and serum potassium was 7.6 mEq/L at the time this tracing was recorded.

Hyperkalemia could be accounting for all of the findings described for this tracing, which in this case would mean a junctional or sinoventricular rhythm that occurs in association with QRS widening and T wave peaking. Alternatively, the Q wave and subtle ST-T wave findings in lead aVL could reflect infarction of uncertain age that occurs in the setting of a junctional rhythm and LBBB pattern. A final possibility is that this rhythm could represent accelerated idioventricular rhythm (AIVR), as determined by the presence of QRS widening, a rate of 80/minute, and lack of atrial activity. ❖

In Future Issues:

Detecting Foreign Bodies with Metal Detectors

BIOTERRORISM WATCH
Preparing for and responding to biological, chemical and nuclear disasters

Ring of Fire: CDC plan to immunize around first smallpox cases has the devil in the details

Used successfully to eradicate smallpox in 1980

Should a bioterrorist strike with smallpox, the Centers for Disease Control and Prevention's (CDC's) recently released response plan calls for investigators to rapidly immunize a "ring" around the first cases. The ring concept calls for isolation of confirmed and suspected smallpox cases followed by contact tracing, vaccination, and close surveillance of contacts.

"Ring vaccination — sometimes called search and containment —- is identifying individuals with confirmed smallpox and then identifying and locating those people who came in contact with that person, and vaccinating those people in outward rings of contact," says **Harold Margolis**, MD, CDC senior adviser for smallpox preparedness. "This produces a buffer of immune individuals and was shown to prevent smallpox and to ultimately eradicate this disease."

Indeed, the ring approach was used to successfully eradicate smallpox from the world in 1980. The only officially acknowledged stocks of live virus remaining are in the United States and Russia, but bioterrorism experts have long feared that smallpox may have fallen into other hands.

But the ring concept was effective when the demographics of smallpox were very different, when few were infected and the vast majority of people were already immune. The CDC plan acknowledges as much, noting that several current factors could contribute to a more rapid spread of smallpox than was routinely seen before this disease was eradicated.

These factors include virtually nonexistent immunity to smallpox, increased mobility of the population, and delayed recognition of smallpox by health personnel who are unfamiliar with the disease, the plan states. Concerning the latter — similar to the fine line between initial symptoms of anthrax and influenza — one of the most confounding differential diagnoses for smallpox is chickenpox. **(See related story, p. 3.)**

Preemptive strike

While the ring strategy is a classic public health approach, some favor a more aggressive preemptive action in this new age of bioterrorism: Immunize response teams of health care workers throughout the nation.

"I would be in favor of a plan to prospectively immunize not only the strike force at the federal level, but [also] a cadre of people in each state," says **William Schaffner**, MD, chairman of preventive medicine at Vanderbilt University in Nashville.

Having groups of health care workers immunized in advance could also be critical if the "ring" is difficult to perceive, he notes.

"We think of it conceptually as a ring, but clearly people are not all in one geographic area," he says. "The people who may or may not have contact with this first case will be scattered all over the community. They went shopping

This supplement was written by Gary Evans, editor of *Hospital Infection Control.* Telephone: (706) 742-2515. E-mail: gary.evans@ahcpub.com.

there, had a church group here, and then they played bridge. The first thing we will be looking for is information from public health authorities about who is within the ring and who is outside the ring. If that is not articulated with great clarity everybody is going to be in deep trouble."

The CDC is certainly aware of such issues and concerns, and discussions are still ongoing within the agency about preemptively immunizing some health care workers. "We have to weigh the risks and benefits of vaccination for any group, and that would include health care workers. We are kind of working through those issues right now," **Lisa Rotz**, MD, medical epidemiologist in the CDC bioterrorism response program, tells *Bioterrorism Watch*.

The overriding factor in holding back immunization of health care workers is the hazards and side effects of the vaccine.

"In 1972 we actually discontinued routine vaccination [in the United States] because the risks of adverse events from the vaccine outweighed the risk of any one person coming down with smallpox, even though it was still occurring in other parts of the world," Rotz says. "I think that still holds true here. We are dealing with a vaccine that presents problems in and of itself."

Indeed, death occurs in about one per million primary vaccinations, usually as a result of progressive vaccinia, post-vaccinal encephalitis, or severe eczema vaccinatum. Other adverse events include inadvertent inoculation from the vaccinated site (e.g., to the eyes).

CDC will bring vaccine within 'hours'

In addition, the CDC has immunized approximately 100 of its personnel, who could be dispatched immediately to a stricken area and begin investigating and administering vaccine.

"We have people trained to respond to smallpox who can go rapidly to an area to evaluate a case, and then help the local and state officials begin implementing control measures," Rotz says. "That would include helping them implement surveillance, making sure we have identified people who need to be vaccinated right away and to start setting that up. We would get things started there until they get their own response up and running."

But instead of immunizing health care workers in advance, the CDC plan is to administer the vaccine after a case occurs. The CDC could deliver personnel and vaccine within "hours" to any area in the country, Rotz says. Moreover, the vaccine can be effective up to four days after infection sets in, and may prevent death in the patient.

Among the top priority for immunizations after smallpox is reported are "those involved in the direct medical care, public health evaluation, or transportation of confirmed or suspected smallpox patients," the CDC plan states. **(See story on priority immunization groups, p. 3.)** In addition, smallpox patients would be placed under airborne precautions similar to that used for tuberculosis patients, who are placed in negative pressure rooms (vented outside) and treated by workers with respirators.

Another important factor in favor of the CDC approach is that smallpox is not communicable in its incubation period, says **D.A. Henderson**, MD, director of the office of public health preparedness at the Department of Health and Human Services in Washington, DC.

"You have an incubation period of 10 to 12 days when the individual feels perfectly well and is not able to transmit infection," he says. "Then he gets a fever for a couple of days and then the rash. It's only when the rash begins that the individual transmits the disease. So, in fact, [those are] the people we're really concerned about isolating so that they don't transmit the disease. But just because somebody's infected does not mean that they're going to transmit infection during that incubation period. They won't do that."

Into the thousands very quickly

Still, while emphasizing that the CDC plan is a good starting point, Schaffner argues that it would make sense — and allay subsequent chaos — to immunize groups of health care workers before an event occurs.

"The immediate [CDC] public health strike team is like being out on the beach and walking in up to your ankles, but the next step you take gets you into water over your head," he says. "Because if you start thinking about [immunizing health care workers], you're talking about emergency personnel, ambulance drivers, infectious disease doctors, [and] nurses in hospitals who would be designated to care for such patients. It could get into the many thousands very quickly."

In addition, with the exception of the recently trained CDC personnel, few clinicians in the country know how to administer the smallpox vaccine using the "little pitchfork" bifurcated needle.

"That is one potential benefit of vaccinating a group of first responders around the country,"

Schaffner says. "You train these people how to administer the vaccine and all of sudden you have a bunch of trained people out there that we haven't had before. I think that would be a substantial additional benefit." ■

Health workers, contacts priority for vaccination

Others include lab personnel and waste disposal

According to the Centers for Disease Control and Prevention (CDC), the following groups should be a high priority for smallpox vaccination should a bioterrorism release of the pathogen occur:

1. Face-to-face close contacts (less than or equal to 6.5 feet or 3 meters), or household contacts to smallpox patients after the onset of the smallpox patient's fever. Although individuals with smallpox are not infectious until the onset of rash, vaccinating contacts from the time of the onset of fever helps provide a buffer and assures that contacts who may have been exposed at the early onset of rash, when the rash may have been faint and unrecognized, have been vaccinated.

2. People exposed to the initial release of the virus (if the release was discovered during the first generation of cases and vaccination may still provide benefit).

3. Household members (without contraindications to vaccination) of contacts to smallpox patients' (to protect household contacts should smallpox case contacts develop disease while under fever surveillance at home).

Household members of contacts who have contraindications to vaccination should be housed eparately from the other vaccinated household members until the vaccination site scab has separated (approximately two weeks) to prevent inadvertent transmission of vaccinia virus. They should also be housed separately from the contact until the incubation period for smallpox has passed and the contact is released from surveillance.

4. People involved in the direct medical care, public health evaluation, or transportation of confirmed or suspected smallpox patients (this includes personnel whose public health activities involve direct patient contact such as case interviewing).

5. Laboratory personnel involved in the collection and/or processing of clinical specimens from suspected or confirmed smallpox patients.

6. Other people who have a high likelihood of exposure to infectious materials (e.g., personnel responsible for hospital waste disposal and disinfection).

7. Personnel involved in contact tracing and vaccination, or quarantine/isolation or enforcement, or law-enforcement interviews of suspected smallpox patients.

8. People permitted to enter any facilities designated for the evaluation, treatment, or isolation of confirmed or suspected smallpox patients. (Only essential personnel should be allowed to enter such facilities.) Only personnel without contraindications to vaccination should be chosen for activities that would require vaccination for their protection. Personnel with contraindications should not perform duties that would place them at risk for smallpox exposure and should otherwise only be vaccinated if an exposure already has occurred.

9. People present in a facility or conveyance with a smallpox case if fine-particle aerosol transmission was likely during the time the case was present (e.g. hemorrhagic smallpox case and/or case with active coughing). Evaluation of the potential risk for aerosol transmission and initiation of vaccination for non-direct contacts will be done by CDC, state, and local public health personnel. The decision to offer vaccination to non-direct contacts of smallpox cases will be made jointly by federal and the state health officials. ■

Smallpox or chickenpox? How to make the diagnosis

Rash progression, location, will be different

Smallpox or chickenpox? That clinical question has been long confined to the academic dustbin in the United States, where the last case of smallpox (variola) was diagnosed in 1949 in Texas.

Smallpox has been vanquished yet is still feared; chickenpox (varicella) remains a fairly common pediatric infection. Continuing use of the varicella vaccine (recommended for use in the United States in 1996) should continue to reduce cases of chickenpox in the years to come. With

Smallpox vs. Chickenpox

	Variola	Varicella
Incubation	7-17 days	14-21 days
Fever prodrome	2-4 days	minimal/none
Distribution	face/extremities	trunk/clusters
Progression	synchronous	synchronous
Scab formation	10-14 d p* rash	4-7 d p* rash
Scab separation	14-28 d p* rash	<14 d p* rash
Lesions soles/palms	yes	no

** d p = days after rash onset*

Source: Centers for Disease Control and Prevention, Atlanta.

bioterrorism a reality and a whole generation of medical students having never seen a case of smallpox, the Centers for Disease Control and Prevention (CDC) is again emphasizing the classic distinctions between the two poxes.

Though similar at onset, the two rash diseases take distinctly different progressions that provide more than a few telltale signs, says **Lisa Rotz**, MD, medical epidemiologist in the CDC bioterrorism response program. **(See chart, above.)**

"The incubation period for both diseases spans similar time periods, but we do see a longer incubation period in the development of chickenpox as opposed to smallpox," she says.

Usually symptoms such as high fever, malaise, and backache will proceed development of rash in smallpox cases. On the contrary, fever associated with chickenpox generally appears in conjunction with the first signs of rash.

"You will also see a different distribution of lesions of the rash between the two diseases," Rotz says. "In general, smallpox lesions are much more numerous on the face and extremities."

In contrast, chickenpox lesions are more numerous on the trunk, and occur in clots or clusters. Moreover, as rash progresses in smallpox, the lesions in a particular area of the body progress along the same lines and appear similar.

"Whereas in varicella in any one area of the body you may see lesions in different levels of progression," she says. "You might see a vesicle next to a scab. Also the rash of varicella progresses much more quickly and resolves more quickly than the rash of smallpox. So the overall illness has a much shorter course for chickenpox vs. smallpox."

As opposed to chickenpox, smallpox also will reveal itself through lesions on the soles and palms of those infected. Despite the disease names, chickenpox lesions are usually smaller than those created by smallpox.

"It is difficult to distinguish early on between the two diseases, but they quickly diverge in their rash progression," Rotz says. "By day five a child with smallpox is showing increasing numbers of lesions still occurring on the face, while the child with chickenpox has about the same number of lesions on the face as appeared on day three. By day seven the rash is still progressing in the patient with smallpox but seems to be resolving in the child with chickenpox."

Though smallpox patient isolation measures are understandably more stringent, the patient isolation guidelines for the two diseases are actually very similar. The CDC recommends contact isolation for both (until scabs are gone) and airborne isolation measures for patients infected with either chickenpox or smallpox. Contact precautions include wearing gloves and a gown to enter the patient's room; removing gloves and washing hands with an antimicrobial soap prior to leaving room; dedicating noncritical care items to individual patients; and taking extra care to clean the patient environment.

Airborne precautions call for placing the patient in a private room that has monitored negative air pressure in relation to the surrounding areas; six to 12 air changes per hour; and discharge of air outdoors or monitored high-efficiency filtration of room air before the air is circulated to other areas in the hospital. Keep the room door closed and the patient in the room, the CDC advises. Health care workers immune to chickenpox need not wear respiratory protection, but the CDC is calling for workers to wear N95 respirators — typically used for tuberculosis patients — when caring for smallpox patients. ■