Notes from the Chair
by Catherine M. Foss, BS, RRT, RPFT

Season’s Greetings! As I write this column in mid-October, I have just returned from the AARC International Congress in Cincinnati. The Congress included some great diagnostics sessions, as well as a follow up business meeting on the last day. For those of you who were unable to attend, the minutes of the business meeting are featured in this Bulletin.

The last few months have been a time of personal adventure and renewal. I would like to thank those of you who voted in the AARC election for section chair. I feel fortunate to have won the election and am looking forward to my continued service as your chair. This fall, I also relocated to Raleigh, NC, and am now working at Duke Hospital. If you tried to send me an email in September or October and did not receive a response, please resend your message to my new address: foss0005@mc.duke.edu.

As we prepare to enter the new year, I would like to ask that each of you place a new emphasis on your professional growth and development. There are many opportunities for you to share your knowledge and assist peers in the diagnostic respiratory field. I have committed myself to serving as your chair-elect and chair over the next four years. But I need feedback from all of you regarding the needs of our section and the directions you believe it should take. I also need your assistance with section activities. Opportunities for involvement include:

• Serve as editor of the Bulletin.
• Write an article for the Bulletin. This is a great way to share your experiences or thoughts with your peers.
• Submit proposals for topics at the 2001 AARC International Congress in San Antonio, TX. You can email me with your ideas, post them on the section listserve, or send your thoughts in proposal form directly to the AARC. The proposal forms are located on the AARC web site. Log onto www.aarc.org, then click on the area called “Request for Proposals” and follow the directions given there. The deadline for submitting topics is December 29.
• Serve as our Internet coordinator. This individual is responsible for suggesting links to place on the Diagnostic Section area of the AARC web site and either responding to diagnostic issues posted on the AARC listserve or referring such issues to the chair for attention.
• Serve on the section’s Nominations Committee.
• Serve on the section’s Specialty Practitioner of the Year Committee.

Finally, I’d like to make special mention of several members who gave many hours of their valuable time to assist the section over the past year: Carl Mottram, past chair, for mentoring and guidance; Susan Blonshine and Steve Nelson, for serving as our internet coordinators; and Pauline Wulbrecht and Joyce Canterbury, who worked diligently as our Bulletin editors. My sincere appreciation to all of you and everyone else who helped make 2000 another successful year for our section.

Diagnostic Section Business Meeting Minutes
by Catherine M. Foss, BS, RRT, RPFT

The Diagnostic Section business meeting was convened at the AARC International Congress on Tuesday, October 10. The following topics were discussed.

• Communications

The Diagnostics Bulletin, which is published six times a year, is looking for peer input. Featured topics include cardiac, multi-disciplinary, pulmonary physiology, pulmonary function, bronchoscopy, polysomnography and sleep issues, and blood gases.

• Networking

The AARC website, www.aarc.org, features a “members only” area for section members, which can be accessed by clicking on the “Community” heading.

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Diagnostics Bulletin

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on the main page. Section members can sign up for the Diagnostics listserve at no additional cost. Members are also encouraged to share their favorite Internet sites with their peers. Email your sites to Cathy Foss or simply post them on the listserve and we’ll add them to the list. In addition to these network-accessing opportunities, section members may access a Resource Directory consisting of peers who have volunteered to answer questions in their area of expertise.

Diagnostic Section’s future

Recruitment of new members to both the AARC and the Diagnostic Section is vitally important. Bill Dubbs, AARC associate executive director, spoke to the group on this matter, reinforcing the opportunity that exists for our section to earn a seat on the AARC Board of Directors. We must have at least 1000 members to acquire a seat, and thus a say in the future and direction of the AARC. We currently are just above 900 members.

Section Opportunities

Members are encouraged to get involved in the section by serving as: Internet coordinator, Bulletin editor, Section Chair, or simply post your sites to Cathy Foss or simply post them on the listserve and we’ll add them to the listserve. Members are also encouraged to share their favorite Internet sites with their peers. Email your sites to Cathy Foss or simply post them on the listserve and we’ll add them to the list. In addition to these network-accessing opportunities, section members may access a Resource Directory consisting of peers who have volunteered to answer questions in their area of expertise.

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Obtaining arterial blood for blood gas analysis has become a routine procedure in most hospitals and many outpatient clinics. Thirty years ago, arterial punctures were primarily performed by physicians because of the potential for serious complications. Today, with improved training and equipment, it is commonly performed by nurses, laboratory technicians, and respiratory therapists, without physician assistance.

Arterial blood samples from the upper extremities are usually performed using the radial artery, even though radial artery punctures are often technically more difficult to perform and may cause the patient more discomfort. The radial artery is preferred because of the common belief that brachial artery punctures are significantly more dangerous for the patient.

In our pulmonary laboratory, brachial artery puncture has been the preferred method for obtaining arterial blood for blood gas analysis for >30 years. This route was preferred because of the common belief that it was safe, caused less discomfort, and was technically easier for the technician. We found surprisingly little information about the incidence of complications for brachial or radial artery sampling in the medical literature. Most published reports were anecdotal, detailing complications without reference to the rate of occurrence. This prompted us to report the incidence of complications in 6,185 consecutive brachial artery punctures performed for blood gas analysis in our laboratory between 1992 and 1996.

Materials and methods

We prospectively recorded the following information on all patients having arterial blood gases drawn: (1) the arm from which blood was obtained; (2) the number of sticks required to obtain the sample; and (3) the presence or absence of any complication at the time of the procedure. Each time a complication occurred, the medical record was reviewed 48 h and 2 months later to ascertain the seriousness, duration, and outcome of the complication. We encourage our patients to be in support groups to help them through various situations — this is no different. If we are to have guidelines that apply to all diagnostic practitioners, we must have a place where we can come together to have input. Pauline, who has been a member of the AARC and the Diagnostics Section since 1992 and has served as co-editor of the Bulletin for the past two years, credits membership in the section with increasing her ability to bring state-of-the-art practices to patients at her hospital. “Our knowledge grows by talking to others about like experiences or new things we may want to try. We encourage our patients to be in support groups to help them through various situations — this is no different. If we are to have guidelines that apply to all diagnostic practitioners, we must have a place where we can come together to have input.”

The Safety of Brachial Artery Puncture for Arterial Blood Sampling

by Gyman C. Okeson, MD, FCCP; and Pauline H. Wulbrecht, RPFT

Editor’s Note: The following article, which was published in CHEST in 1998 (114:748-751) and is reprinted here with permission, grew out of concerns by some medical staff about having our pulmonary lab at Scott & White Hospital in Temple, TX, perform brachial punctures. A literature search showed a dismal lack of information, in fact most “horror” stories about complications of brachial puncture appeared to be hearsay or not well documented. In response, we decided it was time to speak up about our experiences, and a review of all punctures was initiated. As this study shows, well-trained staff can do brachial artery punctures safely. My medical director and I encourage all respiratory therapists to speak up when it comes to the appropriate procedure for radial or brachial arterial puncture. RH, you are the experts! — Pauline Wulbrecht

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• 2001 Program

Practitioners, we need your input!

Program proposals are due December 29 for the International Congress in San Antonio, TX, Dec. 1-4, 2001. You may fill out a proposal form available online at the AARC website or send your ideas to Cathy Foss via email. Practitioners in the audience suggested the following:

More on polysomnography

Metabolic measurement studies and their use in pregnancy

Using protocols in diagnostics

Having an interactive session for a diagnostic topic such as PFT or exercise interpretation.

Specialty Practitioner of the Year: Pauline Wulbrecht, RPFT

Two years ago, Pauline Wulbrecht, RPFT, clinical manager of pulmonary/immunology and podiatry services at Scott & White Hospital in Temple, TX, was given the opportunity of a lifetime when she was asked to play a major role in relocating her hospital’s pulmonary function laboratory to new space within the institution. Over the next several months, she helped to redesign the layout of the lab, developing what she calls “the model of excellence for pulmonary diagnostic services.” With multiple testing rooms that allow for the performance of all modes of pulmonary function testing, the new lab has a friendlier feel for patients, and services are now delivered in the most efficient manner possible.

At the same time, she has aggressively supported the standardization of testing throughout both the hospital itself and the regional clinics located within the Scott & White system, ensuring that all spirometers and staff follow American Thoracic Society standards. “Clinical decisions are made based on test results,” says Pauline. “Patients should not have to have tests repeated, receive inappropriate medical management, be refused chemotherapy treatment, or be refused admission to one of the military academies because their test results were of poor technical quality but released as valid anyway.”

Pauline, who has been a member of the AARC and the Diagnostics Section since 1992 and has served as co-editor of the Bulletin for the past two years, credits membership in the section with increasing her ability to bring state-of-the-art practices to patients at her hospital. “Our knowledge grows by talking to others about like experiences or new things we may want to try. We encourage our patients to be in support groups to help them through various situations — this is no different. If we are to have guidelines that apply to all diagnostic practitioners, we must have a place where we can come together to have input.”

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Results

During the period of January 1992 through January 1996, a total of 6,185 brachial artery punctures were performed. The subjects were all adults. The age range was 18 to 94 years. Sixty-three percent of brachial artery sticks were performed on patients in their sixth and seventh decades of life, 19% in their fourth and fifth decades, 14% in their eighth and ninth decades, and 4% in patients <50 years of age. Forty-nine percent were female and 51% were male. Seventy-five percent of the arterial sticks were performed on outpatients in the medical clinic, 21% were performed on patients in general hospital wards, and 4% were performed on patients hospitalized in the ICU. Only 155 (2.5%) required more than one stick to obtain the arterial blood sample. One hundred twenty-seven (2.1%) complications were recorded. These occurred in a random fashion, with none arising in patients who required multiple sticks. The complications were of two types. The most common complication recorded was that of extremity pain or paresthesias, which was noted in 123 instances (group 1). Only four punctures resulted in hematoma formation (group 2).

A little more than half of group 1 patients (66 subjects) complained of pain at the time of the arterial stick. Of these, one fourth (16 subjects) complained of temporary diffuse pain in the extremity, one half (33 subjects) complained of localized discomfort at the needle site, and one fourth (17 subjects) experienced a shock-like pain, suggesting that the median nerve had been touched by the needle. Only one patient had discomfort that lasted >48 h. A neurologist saw her 10 days after the procedure. At that time, there was pain without objective ischemic or neurologic change. The symptoms resolved spontaneously, without treatment, sometime prior to a second visit at 2 months. Fifty-seven patients noted no discomfort at the time of the procedure, but developed hand pain or paresthesias in the fingers within 24 h following the procedure. Only one had persistent symptoms. She noted the onset of pain and paresthesias in her thumb 4 days after the procedure. She was evaluated by a neurologist, who found no objective abnormality. The pain subsided within 4 months with the use of oral ibuprofen.

Only four patients had identifiable subcutaneous hematomas after the procedure. None of these patients had arterial cannulations or intra-arterial injections.

Discussion

This prospective study involving 6,185 brachial artery punctures for arterial blood gas analysis documents that this is an acceptably safe procedure with a low incidence of complications when performed by properly trained personnel. We considered all of our complications to be minor, since none had any lasting or serious consequence for the patient. In our opinion, brachial artery punctures are technically easier to perform and generally associated with less discomfort than radial artery punctures. Our results were similar to a 1973 report by Felkner, 2 who found 2,500 arterial sticks without serious complication. Unfortunately, Felkner did not categorize complications by puncture site. Petty et al reported in 1986 on the simplicity and safety in 475 arterial punctures with only minor hematoma formation.

The medical literature has been almost totally silent on this subject over the past 15 years. We found no reports that documented the incidence of complications. Most reports involved anecdotal accounts of cases that resulted in complications that, when taken collectively, give the impression that brachial artery punctures are fraught with frequent and serious complications. McCready et al reported one case of limb ischemia noted 6 h after a brachial artery stick. The patient was being treated for an abdominal catastrophe and was in postoperative shock. The ischemia was complicated by the fact that IV fluid had infiltrated into the hand. There was no mention of what medication(s) might have been in the IV fluid. Treatment consisted of a stellate ganglion block. Eighteen hours later, the extremity gradually improved. Subsequent surgical exploration of the arm showed edema of the tissues without other abnormalities. They concluded that the cause of this patient’s limb ischemia was unclear.

In 1976, Neviaser et al reported the complications of brachial and femoral artery punctures in 33 patients who were receiving Table 1—Brachial Artery Punctures: Incidence of Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Incidence (No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial punctures</td>
<td>6,185</td>
</tr>
<tr>
<td>Total complications</td>
<td>127 (2.0)</td>
</tr>
<tr>
<td>Immediate pain/paresthesias</td>
<td>66 (1.1)</td>
</tr>
<tr>
<td>Delayed pain/paresthesias</td>
<td>57 (0.9)</td>
</tr>
<tr>
<td>Hematoma formation</td>
<td>4 (0.06)</td>
</tr>
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heparin therapy. The complication rate was not reported even though complications were categorized by puncture site. Two patients had hematomas after brachial artery sticks. They reported large hematomas that were associated with the development of median neuropathies. They also reported the development of infected hematomas after repeated arterial punctures performed through the existing antecubital hematomas. This report underscores the importance of proper attention to the arterial puncture site during and immediately after the procedure and the importance of not repeating the procedure in an extremity after a complication had already arisen. Both of the reported cases required incision and drainage of the affected arm and, in one case, required skin grafting. They reported two mediastinal neurovascular, one with incomplete recovery of motor function 1 year later, and the second recovering after decompensation and neurolysis. They also described seven patients presenting with ischemic change secondary to bruising and tension of the flexor compartment of the forearm. At surgical decompensation, they noted ecchymoses and swelling that extended from the antecubital fossa into the carpal canal.

An extensive 1967 study by Mortensen of 3,093 arterial needle punctures, cannulation, and cut-downs reported on 66 major complications and 321 minor complications. The study included all arterial punctures for any reason, including arteriography and carotid puncture-decompression. Of the thousand four hundred sixty-six percutaneous artery punctures, 11 had a major complication rate of 1.3% and minor a complication rate of 10%. The remainder of the arterial punctures involved arteriography performed by the Seldinger technique (719) and cutdown arteriography with repair (1,008). The Seldinger technique, which is no longer in use, was associated with an increase in complication rates (14.4% and 14.3% respectively). Of the percutaneous needle punctures, there were only 54 brachial artery punctures listed, but they reported an 8.9% rate of major and a 3.3% rate of minor complications. Overall, they listed the factors predisposing to complications as follows: (1) an age of <10 years; (2) concurrent anti-coagulation. Three authors made a plea for objective studies of complication rates, since anecdotally recollection is frequently faulty.

The most recent report that we found was a 1989 case report by Berger. This involved a patient who had developed a median neuropathy following brachial artery puncture. This report lacked specific information about the resulting median neuropathy. He reported immediate pain of neuropathic type when the nerve was struck by the needle. The pain resisted all treatment modalities for >1 year and appeared to result in permanent sequelae. Unfortunately, the article specifies that there was “pain at the site of the injection,” but fails to indicate what, if anything, was injected.

Ward and Green reported on 588 patients who underwent 1,380 arterial punctures of various kinds. They reported only one potential complication of a brachial artery puncture. The complication occurred in a patient with a cannulated brachial artery who had had a right middle lobectomy but who also had developed postoperative GI bleeding and shock. The extremity where the arterial puncture occurred became pale, cold, and Hypoxemic. After hydration and reestablishment of BP, the pulse returned. Again, there was no mention of the number of procedures by puncture site. They concluded that complications increased when radiographic dyes or drugs were injected into the arteries, there was significant atherosclerosis, or there was long-term catheterization of the artery.

We believe that our results show that brachial artery puncture for arterial blood gas analysis is an acceptable safe procedure in adults when performed by trained, experienced personnel following established guidelines. We believe that the immediate withdrawal of the needle at the first perception of neuropathic pain is important, and that further arterial punctures should not be done in that extremity. It is also important to apply adequate pressure over the puncture site for at least 3 min to prevent hematoma formation. The puncture site should be inspected carefully for signs of hematoma formation after pressure is discontinued so that pressure can be re instituted if bleeding is suspected. We would certainly agree that anticoagulation would increase the potential risk of hematoma formation and would require pressure to be applied for a much longer time than usual. Although we did not record the number of arterial punctures done on patients who were receiving anticoagulant therapy, none of the patients who developed hematomas had been receiving anticoagulants. Most of our patients were in the age group in which attherosclerosis and hypertension are common. If these conditions contribute to the risk of complications, as others have suggested, the influence must be very small. None of our patients had received intra arterial injections. It is conceivable that this could increase the complication rate, depending on the nature of the material injected. The literature would suggest that complications may be more severe in patients who are in cardiovascular shock at the time arterial blood is obtained.

**Diagnoses Bulletin**

**FYI...**

New test classifies bacteria in CF lungs

A laboratory test developed by University of British Columbia researchers allows cystic fibrosis patients to be identified earlier with the presence of specific genetic mutations. The test involves isolating DNA from the sputum and comparing it to a library of known bacterial genes. The test is non-invasive and can be performed at home. The results can help doctors determine the most effective antibiotic treatment for each individual patient. The test is currently being evaluated in a clinical trial and has the potential to revolutionize the management of cystic fibrosis.

**References**

2. Feltzer D. A protocol for teaching and maintaining arterial puncture skills among respiratory therapists. Respir Care 1973; 18:700-705
10. Ward RJ, Green HD. Arterial puncture as a safe diagnostic aid. Surgery 1965;57:672-675

**“FYI” continued from page 6**
Lung function data on Chinese children and adolescents

Researchers who gathered lung function data on normal Hong Kong-born Chinese children and adolescents between the ages of 7 and 19 found that flow volume capacity (FVC) in boys was 8% to 19% lower than figures for white youngsters. Study results compare independently, less than half the normal Hong Kong-born Chinese children and adolescents between the ages of 7 and 19 reported feeling sleepy often or always, while 62% said they lacked energy or always, 57% reported problems with fatigue, and 6% said they felt tired. Women were more likely to describe such symptoms.

As of the end of October, the section had received the following response to its request for information about JCAHO site visits.

Formation of the biofilm. By growing as a biofilm, bacteria can survive and thrive in hostile environments. Although the P. aeruginosa isolated from the lungs of CF patients looks like a biofilm and acts like a biofilm, until now there has not been an objective test available to confirm that it is a biofilm. In this study, researchers developed a sensitive new test which shows that Pseudomonas from CF lungs produce the telltale, quorum-sensing molecules that are the signals for biofilm formation. They believe the most exciting implication of this result is that it could be used to develop automated processes to test thousands of compounds for the ability to disrupt biofilm formation. Says lead study author, E. Peter Greenberg, PhD, “I think this will attract interest from industry where they are very interested in being able to use high throughput, automated processes to rapidly identify compounds that inhibit biofilm formation.” (Nature, 10/12/00)

The AARC is currently seeking input from section members regarding the top five areas of concern unique to our specialty area. Please mail, email, or fax your top five concerns related specifically to the specialty. If you would like to share your site visit experience with fellow section members, please fill out the following form and fax it to the AARC or post your comments on the Management Section listserve on AARC Online (www.aarc.org).

For completeness, the section members regarding the top five areas of concern include:

1. What was the surveyors' focus during the site visit?
2. What changes have you made to improve compliance with the guidelines?
3. What suggestions were made by the surveyors?
4. What were the most significant issues identified by the surveyors?
5. How did the surveyors' comments impact your practice?
JCAHO Accreditation Report

The AARC is currently seeking information on JCAHO accreditation site visits. Please use the following form to share information from your latest site visit with your colleagues in the Association. The information will be posted immediately on the AARC web site at http://www.aarc.org/members_area/resources/jcaho.html and will also be featured in the Bulletin.

Accreditation visit you are reporting (choose one):
- Home Care
- Hospital
- Long Term Care
- Pathology & Clinical Laboratory Services

Inspection Date: __________________________________________________________________________________
Facility Name: ___________________________________________________________________________________
Contact: ________________________________________________________________________________________  
(Please provide name and email address.)

1. What was the surveyors’ focus during your site visit? __________________________________________________
_______________________________________________________________________________________________
_______________________________________________________________________________________________

2. What areas were cited as being exemplary?
_______________________________________________________________________________________________
_______________________________________________________________________________________________
_______________________________________________________________________________________________

3. What suggestions were made by the surveyors?
_______________________________________________________________________________________________
_______________________________________________________________________________________________
_______________________________________________________________________________________________

4. What changes have you made to improve compliance with the guidelines?
_______________________________________________________________________________________________
_______________________________________________________________________________________________
_______________________________________________________________________________________________

Additional comments:
Mail or fax your form to:
William Dubbs, RRT
AARC Associate Executive Director
11030 Ables Lane
Dallas, TX 75229
FAX (972) 484-2720