PYOGENIC PERICARDITIS

A STUDY OF FIFTEEN CASES AT THE RED CROSS WAR MEMORIAL CHILDREN'S HOSPITAL, CAPE TOWN

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Most patients admitted to the Red Cross War Memorial Children's Hospital are non-Europeans. Their admissions are usually because of illness caused by an infection, and the high incidence of this may be due to the fact that a large proportion of these children are malnourished. The area drained by the hospital is a wide one with a large multi-racial population. Non-European children are, on the whole, under-nourished, and the unsatisfactory conditions under which they live are very conducive to the development of kwashiorkor, pneumonia, osteitis, etc. Shandling[1] was able to collect 300 cases of osteitis in Cape Town over a 7-year period, while Bowie,[2] Truswell,[3] and Robertson *et al.*[4] all report a high incidence of gastro-enteritis. Pyogenic meningitis and staphylococcal pneumonia are also very common.

It is therefore not surprising that, in the short period since the hospital opened (in the middle of 1956), pyogenic pericarditis has been seen relatively often. Other forms of pericarditis have been excluded from this study. Thus, pericarditis associated with rheumatism, tuberculosis, uraemia, and the collagen diseases is not dealt with here.

CASE MATERIAL

For the 4-year period, September 1956-September 1960, the notes of all patients with the diagnosis of pyogenic pericarditis have been studied. Fifteen proved cases of pyogenic pericarditis have been found. Of these, 1 was a European child, 12 were Coloured and 2 were Bantu.

Their ages ranged from 3 weeks to 12 years (no child over the age of 12 is admitted to the hospital). The analysis of age, sex and race is given in Tables I and II. It will be seen that

TABLE I. SUMMARY OF CASES—GROUP 1 (RECOGNIZED CLINICALLY)

Case no.	*Age (years)*	*Sex*	*Race*	*Length of history (days)*	*Diagnosis on admission*	*Blood culture*	*Pericardial tap (totals in ml.)*	*Organism from pericardium*	*Result*	*Days in hospital*	*Drugs used*
1	8	M	B	8	Septicaemia	*Staph. aureus*	290	*Staph. aureus*	Recovered	48	P, St, Dig.
2	8½	M	C	4	Pneumonia	Nil grown	150	*Diplococcus pneumoniae*	Died	1	P, S, Dig.
3	9	M	C	5	Osteitis	Nil grown	1,090	*Staph. aureus*	Recovered	5 months	P, St, E, N, Cf
4	5	M	C	3	Septicaemia	*Staph. aureus*	Not done	—	Died	1	P, A, CF
5	1¾	M	E	5	Osteitis	*Staph. aureus* (penicillin resistant)	45	*Staph. aureus*	Died	18	P, S, St, Cf, E, Dig.
6	4	F	C	4	Osteitis	*Staph. aureus*	Nil	*Staph. aureus* (postmortem)	Died	11	P, St, CF, T, Dig.
7	2	M	C	14	Empyema	Not done	480	Gram+cocci	Recovered	42	E, N, Dig.

Key: M = Male, F = Female, E = European, C = Coloured, B = Bantu, P = Penicillin, S = Sulphadiazine, T = 'Terramycin', St = Streptomycin, A = 'Achromycin', N = Novobiocin, Cf = Chloramphenicol, E = Erythromycin, and Dig. = Digitalis.

TABLE II. SUMMARY OF CASES—GROUP 2 (FOUND AT AUTOPSY)

Case no.	*Age*	*Sex*	*Race*	*Length of history (days)*	*Diagnosis on admission*	*Blood culture*	*Organisms cultured at autopsy*	*Result*	*Days in hospital*	*Drugs used*
8	5 wks.	F	C	1	Prematurity	Nil grown	*Staph. aureus*	Died	1	T
9	2 wks.	F	C	4	Bronchopneumonia	*Staph. aureus*	*Staph. aureus*	Died	1	P, S
10	3 wks.	M	C	3	Empyema	Not done	*Staph. aureus*	Died	1	Cf, E
11	4 mths.	M	C	3	Empyema	Nil grown	Nil found	Died	1	P, S
12	1½ yrs.	F	C	7	Jaundice	Nil grown	Paracolon organism	Died	2	T
13	9 mths.	M	B	4	Kwashiorkor	Not done	Nil obtained	Died	2	Cf
14	12 yrs.	M	C	14	Osteitis	Nil grown	*Staph. aureus*	Died	2 mths.	Cf, N, E, Dig.
15	1 mth.	F	C	4	Gastro-enteritis	Not done	*Staph. aureus*	Died	2	Cf, neomycin

Key: See Table I.

males were twice as common as females, and the overall mortality was 12, i.e. 80%.

On analysing the case material it was found convenient to distinguish between 2 groups: (1) in which the diagnosis was made clinically, and (2) where it was made at postmortem examination.

Group 1

A clinical diagnosis of pericarditis was made in 7 patients. Four died and the diagnosis in 3 of these was confirmed at autopsy. The fourth patient (case 5) did not undergo an autopsy. In these 7 patients, the diagnosis on admission was: septicaemia, 2; osteitis, 3; and empyema, 2. The average length of history was 5 days, but 1 child had a history of 2 weeks' illness.

Six of these patients had signs of congestive cardiac failure. Pulsus paradoxus, diminished cardiac pulsation, and dullness beyond the apex beat were constant findings. Only once (case 4) was a pericardial friction rub noted. X-rays of the chest showed gross generalized cardiac enlargement in all 7 cases. Four patients had electrocardiograms (ECGs) done. Of these, only 1 (case 7) had typical changes from the start. Case 1 developed diffuse T-wave inversion with slight ST depressions after 2 weeks in hospital. The other two ECGs were within normal limits.

Where the diagnosis was suspected on clinical grounds, pericardial aspiration was performed. This was done in 6 of the patients, and in only 1 was the procedure unsuccessful. The approach used was from below, the aspiration needle being inserted between the left lower costal margin and the xyphoid process, the pericardial sac being entered through the dome of the diaphragm. Varying quantities of pus were aspirated, ranging from a total of 45 ml. to 1,090 ml. in a patient who required 10 aspirations. In 3 instances air was put back into the pericardium, usually about half the volume of the fluid taken off. X-rays taken immediately after the air instillation showed the size of the pericardial sac. No mishaps occurred with this procedure and it was found to be very helpful in ascertaining the amount of pus still present.

In 6 of the 7 patients blood cultures were performed. Four of these grew coagulase-positive *Staphylococcus aureus*, i.e. 66% had a proved bacteraemia. In 3 of the 5 patients who had successful pericardial aspirations, *Staphylococcus aureus* was grown from the pericardial aspirate, and in 1 patient *Diplococcus pneumoniae* was grown. The fifth gave no growth, but numerous Gram-positive cocci were seen on a stained smear. In 2 of the 3 patients with osteitis, coagulase-positive *Staphylococcus aureus* was grown from the bone lesions.

The drug sensitivities of the organisms isolated were tested in all instances to penicillin, streptomycin, chloramphenicol, erythromycin and 'terramycin'. With 1 exception they were sensitive to all these, the exception being a staphylococcus resistant to penicillin (case 5). In this child the staphylococcus

grown from the blood culture was resistant, but that from the pericardium was sensitive; a curious anomaly.

Group 2

The diagnosis of pericarditis was made at autopsy in 8 patients in whom it was unsuspected before death. Five of these patients were under 6 months of age, 2 were between the ages of 6 and 18 months, and 1 was 12 years old. Of the 7 patients under the age of 18 months, 1 was a premature baby, 1 had kwashiorkor, 1 gastro-enteritis, 1 jaundice of unknown origin and 3 were thought to have bronchopneumonia. All these infants were extremely ill and died within 48 hours of admission. The 12-year-old boy was treated for 2 months for acute bacterial endocarditis. He died suddenly of acute cardiac failure. At postmortem examination he was found to have had acute bacterial endocarditis, a cardiac aneurysm, diffuse pyogenic pericarditis, and multiple foci of osteitis.

At postmortem examination, in addition to pyogenic pericarditis, 6 patients had pneumonia and empyema; the patient with jaundice had a suppurative pyelonephritis, and the patient with kwashiorkor had a fatty liver and dilated heart.

Five of this group had blood cultures performed; of these only 1 was positive (*Staphylococcus aureus*). In 6 others, organisms were recovered at autopsy from either the pericardium or some other site, e.g. osteitis or empyema. In 5 cases the organism was a coagulase-positive *Staphylococcus aureus* and in 1 a paracolon strain. In 2 cases the pus and blood cultures were sterile.

TREATMENT

Group 1

In this group all except one of the patients were thought to be in cardiac failure and were digitalized.

Penicillin and sulphadiazine only were used in one fatal case. Penicillin and streptomycin were given to another child who recovered. Usually, however, the initial treatment was penicillin and sulphadiazine or streptomycin until the result of one or other culture was known, when treatment with the appropriate antibiotics was started. If the patient did not respond within 48 hours, the antibiotics were changed. A combination of two or more antibiotics was the rule, but no fixed antibiotic combination was used. Chloromycetin and erythromycin were employed in 2 cases, chloromycetin and 'albamycin' in 2 others. Two patients each had 5 different antibiotics. No correlation could be found between the drugs used and the outcome of the illness.

Pericardial aspiration was performed on 6 of the 7 patients. The seventh patient had a friction rub, but no aspiration was done. The diagnosis was confirmed at autopsy. In those aspirated, all the obtainable pus was removed and the procedure was repeated daily until aspiration failed to produce any further pus, or the patient died. In no case was open drainage performed. In 1 patient 10 aspirations were carried out and the patient recovered completely. In some instances, penicillin was injected into the pericardial sac, but this was not a routine measure. In 1 patient (case 7) desoxyribonuclease (deanase), 1 million units dissolved in 2 ml. of normal saline, was injected into the pericardial sac. Empyema thoracis was treated by repeated needle aspirations. Osteitis was dealt with by drilling, drainage, and immobilization in plaster.

Group 2

All these patients received anti-infective therapy as shown in Table II. No local therapy was given since pericarditis was not suspected. No digitalis was used.

Resumé and Outcome

Pyogenic pericarditis in children, as seen in this series, was divisible into 2 groups, those clinically recognizable and thus treatable, and those whose pericarditis was part of a generalized septicaemia and was not diagnosed during life. The detectable ones were usually more than 18 months of age, the others younger. In 66·6% of cases the organism was *Staphylococcus aureus*. Paracolon organisms and pneumococci were the only other ones isolated. There were only 3 survivors, but their recovery was complete, and follow-up has not revealed any sequelae or constriction. One patient has been followed-up for 4 years and there is no evidence of chronic pericardial disease.

DISCUSSION

Purulent pericarditis is not common. Haran[5] reported on 27 cases of pyogenic pericarditis collected over 18 years; Schrire,[6] in 6 years, collected 5 cases under the age of 10. In the 4 years under review, 10,900 patients were admitted to the Red Cross War Memorial Children's Hospital.[10] Pyogenic pericarditis (15 cases in this series) thus accounts for only 0·14% of the total. The condition occurred in both medical and surgical patients and may well have been more frequent, since permission for autopsy is often refused. The nature of the infection, either as an extension of a presenting intra-thoracic disease or as part of a septicaemia, makes close collaboration between physician and surgeon imperative. In no case was the diagnosis indicated by the history, and the fact that more than half the diagnoses were made after death is not flattering.

Haran,[5] in a review of 27 patients, states that the diagnosis is not easy; this is in keeping with our own findings. On admission, all but one of the children in group 1 were thought to be in congestive cardiac failure. They showed the usual signs of this condition and were treated accordingly. Many of our patients are in a similar state on admission. The primary difficulty lies in the detection of cases. In contrast to what is commonly found in rheumatic and tuberculous pericarditis,[6] praecordial pain, pericardial friction, and distant or muffled heart sounds are either not present or are readily missed in very young children. A friction rub was heard in only 1 patient out of 7 in group 1. Cardiomegaly and pulsus paradoxus were noted in every case, but in children with rapid respiration pulsus paradoxus is often a difficult sign to elicit and, when present, is not diagnostic.

In all the cases X-rayed, the picture is suggestive, but not reliable, and the diagnosis has to be tested by a pericardial tap, a procedure which is not lightly embarked upon, especially in a critically ill infant. In one patient in this series no pus was obtained, but the diagnosis was established at autopsy.

The infecting organisms in 10 — probably 11 — of the present 15 cases was a staphylococcus; in one it was a paracolon organism; and in another *D. pneumoniae*. Many blood cultures were sterile and it was not unusual to fail to find the causative organism even in the pericardial pus. Consequently, rational treatment cannot always be decided with certainty by assiduous use of bacteriology, and the choice of a therapeutic agent must depend, in the first instance, on probability.

In approximately 80% of the entire present series a staphylococcus appeared to be the infective agent, and the sensitivity tests showed that it was almost invariably sensitive to any one of the 6 drugs used. This was a surprise in respect of penicillin but is in keeping with Shandling's[1] observation that more than 81% of the staphylococci recovered from osteitis in the Cape Town area were sensitive to all the antibiotics in common use.

The mortality rate did not correlate with the sensitivity of the organism. Two or even 3 antibiotics together failed to save the children's lives. Frequent pericardial aspirations often did not accomplish much. Desoxyribonuclease, on the sole occasion it was used in the pericardium, seemed to produce liquefaction of the pus and a much easier aspiration; it should probably be incorporated in routine treatment. This may avoid the necessity for more heroic measures such as surgical drainage. Before the introduction of antibiotics, purulent pericarditis was invariably fatal, as can be seen in the cases reported by Torrey *et al.*[9] who used only sulphonamides. McGuire *et al.*,[11] Aird,[7] and Cant *et al.*[8] all recommend open drainage in addition to antibiotics. Nadas and Levy[12] state that a small thoracotomy incision is preferable to all other measures for draining the pericardium. Open drainage should be used in those cases which fail to respond to the other methods, but the operation itself is a very serious one for such extremely ill children.

It is obvious that reliance on massive antibiotic therapy is not adequate in pyogenic pericarditis. Whether intra-pericardial instillation of antibiotics would improve matters or not remains to be seen. The other, possibly primary, foci of infection must be attended to on the lines currently acceptable, as they were in this series. The pericarditis cannot be a primary lesion and the treatment must be holistic.

Autopsy reports showed a multiplicity of lesions, no one of which was indictable as the final cause of death.

In spite of the high overall mortality of 80%, those that recover apparently do so completely. Schrire[6] and Haran,[5] in their series, saw no patient develop chronic constrictive pericarditis. The 3 survivors in this series appear to be doing well. This is both encouraging and gratifying, and suggests that more strenuous efforts should be continued to overcome this depressingly dangerous complication of pyogenic disease.

SUMMARY

1. A series of 15 cases of pyogenic pericarditis occurring over a 4-year period have been studied. Seven were recognized clinically and treated.

2. The organism involved in the majority of cases was a *Staphylococcus aureus* sensitive to all antibiotics.

3. The overall mortality rate was 80%, but in those recognized clinically, it was 43%. Where recovery occurred, this was complete.

4. Since massive antibiotic therapy and aspiration, with digitalization and attention to the primary sites of infection, were inadequate, other measures are briefly considered.

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