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A New Type of Contrast Medium in Selective Coronary Arteriography

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ABSTRACT

A new contrast medium Ph DZ 59B when used for selective coronary arteriography was found to give significantly fewer electrocardiographic changes than a currently used metrizoate preparation. The preparations were examined at the same iodine concentrations in patients. The findings confirm earlier results from comparative studies in peripheral arteriography, carotid arteriography and angiocardiography that this newly synthesized agent gives less adverse effects than other contrast agents currently used.

INTRODUCTION

In previous studies, a new contrast agent for angiography was successfully tested clinically in peripheral arteriography, thoracic aortography and carotid arteriography (3–5). The chemical structure of this new contrast compound in its acid form is seen in Fig. 1 and the methylglucamine salt of the acid is referred to as Ph DZ 59B. The new contrast agent was also tested in selective coronary arteriography in a preliminary study (6).

In this paper, an extended comparative study of the new contrast agent Ph DZ 59B and a methylglucamine metrizoate preparation in selective coronary arteriography is presented.

MATERIAL

The material consisted of 43 selective coronary arteriographies in 25 patients. All patients except one were males and their age varied from 29 to 59 years with a mean age of 47 years. Their weight varied between 53 and 94 kg. All patients had to undergo selective coronary arteriography as part of a routine investigation for ischemic heart disease. There was no selection of patients. 23 of the comparative injections were made in the left coronary artery and 20 in the right coronary artery. In 18 patients, both coronary arteries were examined in a comparative manner. All patients, except two, were found to have considerable arteriosclerotic changes in their coronary arteries.

METHODS

The patients were premedicated with 0.1 g pentymal 2–3 hours before the angiocardiography. In addition, 25 mg pethidine was given to the patients 20 min before the examination. The coronary arteries were selectively catheterized by the technique described by Judkins (9). The catheters were percutaneously introduced from the femoral arteries. The two contrast media used were Isopaque cerebral (0.59 g methylglucamine metrizoate and 0.0113 g calcium metrizoate per ml Nyegaard & Co., Oslo) and Ph DZ 59B (0.57 g/ml). The iodine content of the Ph DZ 59B solution was 235 mg/ml and Isopaque cerebral was diluted with distilled water to the same iodine content. Identical volumes (3 or 4 ml) of the two contrast media each having the same iodine content were injected in random order in the coronary artery. The tip of the catheter remained in the same position for both injections. The injections were made manually and the injection time was measured using a stop watch. No significant difference in the injection times with the two contrast media was noted. An interval of approximately 10 min was allowed between the injections to permit the effects of one contrast medium to disappear before the other contrast medium was injected. The electrocardiograms (a modified lead V5) were recorded continuously before, during and after both injections in all patients. In 12 instances, the arterial blood pressure was also measured continuously before, during and after the injection.

For the cineangiocardiographic recording, a 9-inch intensifier (Philips) and 35 mm cinecamera (Arriflex) operating at 75 frames per second was used. A highload roentgen tube with a nominal focus spot size of 0.6×0.6 mm was used. The geometrical magnification technique with a magnification factor of 1.4–1.8 was used. The definition of this recording system is approximately 1.8 pair of lines per mm. The exposure factors for the pulsed cineangiography were 55–70 kV, 320 mA and the duration of each cine pulse was 0.003 sec.

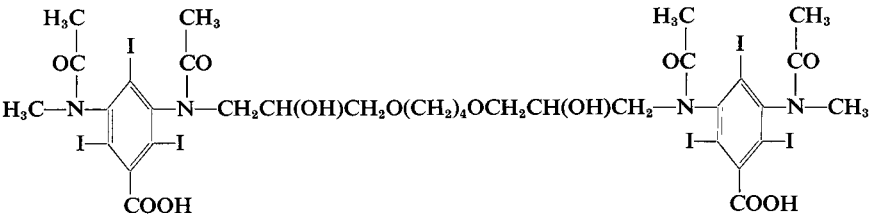

Fig. 1. Chemical structure of the new contrast compound in its acid form.

RESULTS

Coronary cine angiograms of good quality were obtained with both contrast media in all patients.

The electrocardiographic changes after injection of the two contrast media in these comparative studies are seen in Table I. Transient changes in the ST-segment were seen after 14 injections of Isopaque cerebral in 12 patients. Only 6 patients showed ST-changes on 7 occasions after a similar injection in the same artery of Ph DZ 59B. In the cases where ST-changes were seen after injection of Ph DZ 59B similar changes were also evident after Isopaque cerebral. Statistical analysis (sign test) showed that Ph DZ 59B produced significantly fewer ST-changes than the other contrast agent ($p < 0.05$). Extrasystole were seen on one occasion after injection of Isopaque cerebral but in no case after injection of Ph DZ 59B. Whereas injection of Isopaque cerebral caused changes in the heart rate in three instances no changes were detected after similar injections of Ph DZ 59B. The changes in heart rate consisted of a period of asystole of 5–6 sec duration in two patients and ventricular tachycardia with a heart rate of 180/min of 30 sec duration in another patient. In both cases, normal rhythm was regained spontaneously. Widening of the QRS complex was seen in one patient both after Ph DZ 59B and after Isopaque cerebral.

Table I. *ECG changes after 43 comparative selective coronary angiographies*

	S–T changes	Changes in heart rate	Extra systole	QRS changes
Isopaque cerebral	14	3	1	1
Ph DZ 59B	7	0	0	1

No changes in blood pressure were recorded. None of the patients reported any subjective adverse effects from the contrast injections.

DISCUSSION

The quality of the cine coronary arteriograms obtained were satisfactory with both contrast media. The slightly lower concentration and the somewhat smaller dose of the contrast media compared to that generally used had no influence on the angiographic results. This may indicate that, in some instances, the recommended dose and probably also the concentration of contrast medium are unnecessarily high for coronary arteriography (e.g. 1, 9, 14).

The overall incidence of electrocardiographic changes with both contrast media was low in this series. This is probably due to the fact that the concentration and dose were lower than those used in earlier reports. However, from this comparative study, it was obvious that Ph DZ 59B gave fewer electrocardiographic changes when used in selective coronary arteriography than Isopaque cerebral which contains methylglucamine metrizoate and a small amount of calcium metrizoate. A small content of calcium salt in contrast solutions has, in other studies (7, 11, 12), been reported to protect the heart to a certain degree from the toxic influence of some contrast media. Therefore, it is conceivable that methylglucamine metrizoate in the absence of calcium ions may produce even more electrocardiographic changes.

In the USA a methylglucamine diatrizoate solution with very low content of sodium ions was found to give a higher incidence of ventricular fi-

brillation in selective coronary angiography than solutions of similar concentration but containing a mixture of methylglucamine salt and sodium salt. Recent studies using selective coronary arteriography in dogs (8, 10, 13) have confirmed this and demonstrated a beneficiary effect of addition of sodium salt to about normal serum levels of sodium ions to methylglucamine salt solutions of contrast agents used in selective coronary arteriography. In the present investigation both contrast media compared contained no sodium. In spite of that the incidence of electrocardiographic changes and other disturbances was low. The explanation for this is again probably the relatively low concentration and dose used in the present study compared with the high concentrations and the high doses used in the studies cited above.

No absolute parallel may be drawn between the electrocardiographic changes and the adverse effects on the myocardium of contrast media or other hypertonic solutions injected into the coronary arteries. This applies particularly to the ST-changes. Other changes such as ectopic beats, cardiac arrest and ventricular tachycardia are considered to constitute definite evidence for adverse effects on the myocardium by the contrast medium (1, 2).

It is however generally agreed that the electrocardiographic changes are to a certain extent a measure of the toxicity of those contrast media used for coronary arteriography.

This study confirms the results of earlier clinical trials in which it was shown that the general circulation, as reflected by changes in heart rate and blood pressure, is affected less by Ph DZ 59B than by other contrast media currently used. When used for selective coronary arteriography Ph DZ 59B also produced significantly fewer electrocardiographic changes than another currently used contrast medium. It thus appears that Ph DZ 59B is an improvement over other injectable contrast media currently used and further clinical testing of the agent is justified.

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