Differential Diagnosis of Organic and Functional Impotence by the Use of ^{131}I -Human Serum Albumin

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SHIRAI, M. and NAKAMURA, M. *Differential Diagnosis of Organic and Functional Impotence by the Use of ^{131}I -Human Serum Albumin.* Tohoku J. exp. Med., 1970, 101 (4), 317-324 — Seven and nine cases of organic and mental impotence, respectively, were examined for changes in circulating blood in the penis after the administration of ^{131}I -human serum albumin. As a result, there was a remarkable difference in the amount of circulating blood in the penis between the two groups. This method of examination using an isotope was applied to patients in a painless testing situation. It was also simple enough to be performed at any clinic equipped with a renogram apparatus. These results require verification by further studies on a larger number of patients. ——— impotence; ^{131}I -human serum albumin

It is considerably difficult to make a differential diagnosis objectively between organic and functional impotence. Smith and Auerback¹ mentioned that most cases (95-99%) of impotence were induced by a functional factor, and that the best approach was to exclude cases induced by an organic factor at the beginning of the examination.

Various methods have been developed for the differential diagnosis of impotence. Rowan and Howley² devised a method to differentiate objectively one type of impotence from the other. In this method, the criterion used was the maximum electric current to induce an intolerable pain.

Since there is a close relationship between the nervi erigentes and the nerve supplying the urinary bladder, an attempt has been made to clarify the state of the nervi erigentes on the basis of changes in the pressure of the urinary bladder. In our department, another attempt has been made to examine the physiological function of the erection center of the spinal cord and the reflex arc from changes in the electromyogram of the bulbocavernosus muscle.

Cavernosography has also been applied as a method to elucidate changes in the erectile tissue. None of these methods, however, can be said to be satisfactory.

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Therefore, the authors devised testing procedures to offer a method of differential diagnosis of both types of impotence by observing changes in the blood circulation in the cavernous body of the penis by the aid of ^{131}I -human serum albumin. This paper deals with the outline of this trial.

MATERIALS AND METHODS

Only patients suffering from disability of erection were studied in the present investigation. Patients with any disorder in ejaculation were not dealt with in this paper.

A total of 16 patients with erectile insufficiency were examined. Seven of them had experienced trauma or undergone surgical operation of some organ in the pelvic cavity and were regarded as cases of organic impotence from the results of various standard tests. The remaining nine were presumed to be cases of mental impotence. In addition, five normal adult males served as controls and were subjected to the same tests as the patients mentioned above.

In the examination, a renogram apparatus, NaI (Tl) crystal $2'\phi \times 2'1$ (Fig. 1), which is in general use, was employed. A collimator of the cylindrical type was most often used. Such a collimator as shown in Fig. 2 was prepared tentatively for this examination in such a manner as to avoid the counting of gamma rays coming from any portion other than the penis to the largest possible extent. The examination was carried out at a feeding velocity of 15 mm/minute, a time constant of 2 seconds, and a width of the window of 364 ± 36.4 KeV.

The isotope used was ^{131}I -human serum albumin (RISA). It was injected intravenously in a dose of 20–40 μCi . Furthermore, sodium iodide was administered orally prior to the examination in order to block a possible exposure of the thyroid gland to the isotope.

The patients were asked to take a standing, sitting or supine position. Any position would do, but the last one was recommended, since it was most fitted psychologically

Fig. 1. Renogram apparatus in general use. The collimator (A) is covered with filter paper and the penis is allowed to enter the collimator as deep as possible. The collimator (B) was used for control.

Fig. 2. New collimator for this examination.

Arrows show the window to enter the penis.

and gave the least pain to patients during the examination, which took more than 30 minutes to complete.

The collimator was covered with filter paper and the penis was allowed to enter the collimator as deep as possible.

The isotope was administered in the manner as mentioned above. Changes in the blood circulation of the penis were recorded as a curve, called radioisotope penogram by the authors. When this curve became flat, the patient was injected subcutaneously with 1 ml of yohimbine preparation and held under observation for any change in this curve. The yohimbine preparation used was Fujicapin, a product of the Fujisawa Pharmaceutical Industry Co. Ltd., containing 0.003 g of yohimbine hydrochloride, 0.008 g of sodium methyl-arginate, 0.0003 g of strychnine nitrate, and 0.0187 g of glucose per cubic centimeter.

RESULTS

1) Findings on the radioisotope penogram of the normal adult male

The curve of the penogram recorded in the normal adult males could be classified roughly into two types. In one type, the curve which had become flat after the administration of RISA began to ascend several minutes after Fujicapin

Fig. 3. Normal penogram, A type (25-year-old male). The upper curve was control wave from the collimator B. The lower curve was penogram. This curve began to ascend several minutes after Fujicapin administration and continued to ascend gradually for 15-20 minutes.

Fig. 4. Normal penogram, B type (27-year-old male). This curve began to ascend after administration of Fujicapin and showed a periodical rapid rise with complete erection.

administration. It continued to ascend gradually for 15–20 minutes and again became flat. This type was called A type (Fig. 3). In the other type, the curve began to ascend after the administration of Fujicapin. It continued to ascend for 15–20 minutes. Thereafter it showed further recurrent rises. This type was called B type (Fig. 4). In the B type, the penis erected completely or incompletely when the curve showed a periodical rapid rise.

2) Findings on the radioisotope penogram of the impotent patient

a) *Findings on the radioisotope penogram in cases of mental impotence.* Penograms were taken from 9 cases of mental impotence. As shown in Table 1 and Figs. 5 and 6, there was an increase in circulating blood in the penis in each case after loading with Fujicapin. In one case, the increase was so remarkable as to cause erection (B type). The other 8 cases gave rise to a curve of the A type. In one of them, the increase in circulating blood was not so conspicuous as in the other cases.

TABLE 1. Penograms of functional impotence

Case No.	Name	Age in years	Causes of impotence	Fujicapin loaded penogram
1	K.I.	31	Honeymoon impotence	Normal pattern, A type
2	M.O.	33	Honeymoon impotence	Normal pattern, A type
3	M.Y.	30	Honeymoon impotence	Normal pattern, A type
4	Y.K.	25	Anxiety of pregnancy	Normal pattern, A type
5	H.K.	27	Anxiety of sexual life	Normal pattern, B type (with incomplete erection)
6	K.Y.	40	Strain of works	Normal pattern, A type
7	M.E.	26	Honeymoon impotence	Normal pattern, A type
8	T.S.	52	Strain of business	Normal pattern, A type (but no remarkable rise)
9	M.A.	35	Anxiety of venereal disease	Normal pattern, A type

Fig. 5. Penogram (B type) of mental impotence (Case No. 5). Periodical rapid rise with incomplete erection was shown.

Fig. 6. Penogram (A type) of mental impotence (Case No. 8). No remarkable rise was recognized.

b) *Findings on the radioisotope penogram in cases with organic impotence.* As shown in Table 2, penograms were recorded from 7 cases of organic impotence after loading with Fujicapin in the same manner as mentioned above. In these cases, the

TABLE 2. *Penograms of organic impotence*

Case No.	Name	Age in years	Causes of impotence	Fujicapin loading penogram
1	T.S.	33	Pelvic bone fracture with urethral rupture	No reaction
2	A.S.	31	Pelvic bone fracture with urethral rupture	No reaction
3	H.O.	22	Large induration of the base of the penis after trauma	No reaction
4	K.O.	63	Retropubic prostatectomy with diabetes mellitus	No reaction
5	Y.K.	34	Traumatic fracture of the vertebrae	No reaction
6	Y.M.	25	Trauma of the head and diabetes mellitus	No reaction
7	K.O.	49	Contusion of the penis, scrotum and perineum	No reaction

Fig. 7. Penogram of organic impotence (Case No. 1). No reaction was recognized after loading Fujicapin.

Fig. 8. Penogram of organic impotence (Case No. 4). No reaction was recognized after administration of Fujicapin.

blood circulation in the penis was not so satisfactory as in the normal adult male or in cases of mental impotence. In any case no reaction was exhibited to loading with Fujicapin (Figs. 7 and 8).

DISCUSSION

The erection of penis is defined as a phenomenon of enlargement of the penis induced by the stagnation of blood in the cavernous body of this organ. It is one of the prerequisites for sexual intercourse.

There are two types of erection, erotic and reflective. In the former type, the erection center of the diencephalon is excited by such cerebral stimuli as sexual excitement, visual, auditory, or olfactory senses and mental imagery. These stimuli descend in the spinal cord down to the erection center of the sacral region of the spinal cord, which is excited and causes the penis to erect. In the latter type, the erection is not induced by such sexual excitements but by the reflex which occurs at a center of the spinal cord unrelated to any superior center and which appears on some occasions, including erection when the urinary bladder is filled with urine. The occurrence of reflective erection is a clinically important indicator, because it shows that the erection center and other portions caudal to it of the spinal cord are sound. In any case, these portions of the nervous system and the erectile tissue must be in healthy condition in order to cause normal erection.

The mechanism of human penile erection has been studied by many investi-

gators, such as Conti³ and Newman *et al.*⁴ We have no intention to discuss it in this paper. In our experiments with the penis of the rat (Fig. 9), a large amount of blood was normally contained in the corpus cavernosum of the penis even in a flaccid state. Then it was questioned whether there might be a difference in the amount of blood circulating in the penis even in the flaccid state between cases of mental impotence and those of organic impotence. To verify this presumption, changes in the circulating blood in the corpus cavernosum of the penis were examined by using isotope. Of the various isotope preparations employed in the preliminary examination, RISA seemed to be most fitted. At present, it is

Fig. 9. Ink perfusion for displaying cavernosous tissue in the rat. A large amount of ink was contained in the corpus cavernosum of the penis which was in a flaccid state.
v: V. dorsalis penis. cp: Cavernosum penis. cu: Cavernosum urethrae.

very likely that the activity of the penis can be estimated by using such low-energy nuclear types of isotope as ¹²⁵I-human serum albumin, and this type of isotope will be applied in the future. Further, experiments were carried out with varying doses of isotope and varying feeding velocities of recording paper, but failed to give any characteristic curves for differential diagnosis of the two types of impotence. Then an attempt was made to differentiate one type from the other by observing changes in the circulating blood in the penis caused by a vasodilator administered when the curve became flat after the isotope administration. The drug used in this attempt was a yohimbine preparation, Fujicapin, which contained also strychnine.

As an alpha-adrenergic blocking agent, yohimbine has a pharmacological action inducing hyperemia of the reproductive organs by dilating arteries of these organs and accelerating the erection of the penis by stimulating the erection center at the same time. It has been reported that an appropriate dose of strychnine also acts as a stimulant to accelerate the erectile reflex.

A renogram apparatus with a collimator of the cylinder type which has been in general use was employed for measurement. To carry out the measurement efficiently by interrupting the gamma-ray coming from any region other than the penis, the

authors produced a particular type of collimator tentatively for the present investigation.

In the penogram of the normal human adult, there was a gradual increase in circulating blood in the penis when Fujicapin had been administered; namely, a gradually ascending curve was presented after treatment. The curve of the penogram was classified into two types. In one type, the curve exhibited a gradual rise constantly. In the other type, a gradually ascending curve was interrupted periodically by a rapidly rising one which was accompanied by complete or incomplete erection of the penis. These two types of curve in the penogram may be derived from an individual difference in sensitivity for yohimbine. Nevertheless, there was an increase in circulating blood in the penis of the normal human adult after administration of yohimbine, regardless of the dose of this drug employed. There was no difference in the penogram between the subject with mental impotence and the normal subject. In both normal and impotent persons, the circulating blood increased in amount in the penis after administration of Fujicapin.

On the other hand, no changes in amount of circulating blood were observed at all in patients suffering from organic impotence after administration of Fujicapin. These patients were affected by some disturbance in the pudendal nerve or the erectile tissue. It is presumed that the method of testing developed in the present investigation may make it possible to determine whether or not the inferior erection center in the sacral region of the spinal cord and other portions caudal to this center is free from any disturbance. Further studies seem to be necessary to verify this presumption by testing a larger number of subjects.

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