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Discussion

Dr. R. SPIRA (*Israel*). I will speak about a successful case of artificial insemination, of which I am bound to say that it is the only success, and in view of the other failures about which you heard there might possibly be some doubt about the paternity in this case. I should mention that it wasn't all that smooth sailing, as we had three previous prostigmine tests in this case which weren't successful, and between the second and third we had done very intensive hormone treatment, which improved considerably the sperm count. On the fourth attempt, which was the last one, it was successful. The pregnancy and delivery were normal and the geneticians and cytologists found it difficult to understand what all the fuss was about, the case was authentic because of the blood group which was suitably matched, and which almost conclusively proved the paternity of the father. There was a second child born in the same family two or three years later. Since a prostigmine test was done in a different centre I cannot claim the authenticity of the second child. All other cases we have done prior to that one were unsuccessful. The last one was done at our hospital on a tetraplegic C6 complete, and we then injected what seems now to be too large a dose, which was 0.4, and there was a very large rise of blood pressure and the injection at that test did not result in obtaining a pregnancy.

Dr. A. JOUSSE (*Canada*). I wonder if you can inform me as to how many of these patients were clinically complete and how many were incomplete. I have one incidence, a man and a woman I knew very well so I assumed there was no collaboration on the side in this case, that I always suspected having listened to Dr. Munro's residents many years ago, who were very sceptical about the results that he hoped had occurred. This man, when he enquired from me as to the possibility of procreation, followed my sage advice, I told him never to give up, and indeed his wife did bear a child. So, for some reason or another it can happen without chemical stimulation, other than that which is inborn. I wonder, too, why prostigmine is not effective if given orally in adequate doses; why must it be given intrathecally?

With regard to what Mr. Talbot said, I have some experience about sex problems with paraplegic patients, I have interviewed many patients on this point. One of the things they told me is that in several cases there was a sort of erogenic area above the highest segment of anaesthesia, to compare with what we see with reflexes. So, they could have satisfaction by rubbing of that area and by touching or letting it be touched. I think it is worth while to know this. I have some questions, apart from this prostigmine injection: Is there experience with conserving of hyperfertile sperma with the use of it for artificial insemination later on? Because, some of my patients ask me the following question: Is it possible for young, male paraplegics, fresh cases, to obtain their sperm and to conserve it for artificial insemination when they are later married? And the last question: I have been told that Dr Schwarzmann in Brussels sometimes makes spermatocele with the help of the vena saphena. In that case, you can get sperms by puncture

and use it for artificial insemination. Is it useful or is it useless in paraplegic patients where most of them are infertile?

P. HARRIS (*G.B.*). I would like to say a word regarding artificial insemination. I wonder if sperm might be obtained, just in case, soon after injury? I don't know enough about this subject, but I would ask this question. Regarding Sir Ludwig's paper, I wonder if we might know how many successful pregnancies have occurred, not so much with the test but the therapy, the actual sexual function using prostigmine, how many successes do we know in this audience for example? And, then, if intracranial haemorrhage occurs occasionally during parturition, or (not often during intercourse) if the person happens to have an embolism, and this is quite prominent and well recognised in neurology and neurosurgery, and blood pressure does go up, then in this case, I wonder, if he knows where the haemorrhage came from? Was this a former congenital lesion, an aneurysm, have we more information?

Dr. J. J. WALSH (*G.B.*). First of all, I very much enjoyed Dr. Rossier's cases, they were extremely well examined and documented. There were two points he made that I would like to comment on: one was the question of very slow drop in blood pressure and also the maintenance of high blood pressure—I think he said even before the ejaculation. We had one case here, a high lesion whom I did twice. On the first occasion, his blood pressure got pretty high, but with very few symptoms, he had 190/130, a very mild headache and nothing else. Incidentally, I would support entirely what Dr. Rossier says about the importance of having these on a monitor; in fact, I won't do a cervical lesion now unless they're on the monitor and there is some ansolin available. But, in this patient, I noticed I injected the prostigmine—he started off well down, I think he was 100/50, lying in bed, within half an hour his blood pressure was 140/100 without erection and without ejaculation. And then, at the height of the ejaculations (he had three) it went away up to 190. So, it may possibly be some other effect of the prostigmine which we don't fully understand.

The other point I would like to mention here is one of interest. I recently had a rather unusual opportunity—a girl in her 34th week of pregnancy, I think it was, who had a car crash resulting in a complete lesion at T5. She came into hospital, in very good condition, she had been having increasing contractions just before the accident and our gynaecologists didn't believe her dates were accurate, but within 48 hours of injury she was getting fairly rapid contractions, and there was some sign that she was in labour. Everything was made ready for her to have her baby, she was seen by the gynaecologist, put on regular blood pressure charts and so on and then the whole thing appeared to die down. She was quite happy, with no change in blood pressure, no symptoms and no pain. Unfortunately during the night she went right into the second stage of labour without any sign of autonomic reaction at all. And, the child was born dead in asphyxia, and in any case the child had very little chance because it was one of the abnormal, very small babies with poor placental supply. But I think it is important that if you get somebody in spinal shock you may very well not get any warning at all of labour taking place.

Professor ASCOLI (*Italy*). Regarding sexual phenomena in paraplegics, it is a particularly interesting fact that we have all seen that in tetraplegics and in lesions of the upper part of the thoracic cord, there is always in the first month after the trauma, a tendency to erections and this tendency to erections generally lasts many months, and then very slowly it becomes less and then disappears. I should like to hear from Sir Ludwig or other colleagues who have more experience than I as to the explanation of this phenomenon.

Sir LUDWIG. I think we had a very interesting discussion and I am very grateful to all colleagues who took part, because these discussions are helpful in a subject which is still rather obscure to many people.

I would like firstly, to comment on the last speaker. It is quite true that in spastic

lesions, and that doesn't apply only to people above T₅, if the treatment is properly done from the start and contractures in the paralysed limbs are avoided, then the spasticity which develops and is increased at some stage, gradually becomes less, particularly in those patients where a co-ordinated reflex function has been developed and exercised by standing in parallel bars and walking. This is now a well-known fact in neurology, and the fact that the first very frequent erections in these spastic lesions die down is accountable, therefore, to the fact that the erection reflex is part of the general heightened reflex synergy of the isolated cord. This has been already described in the classical paper of George Riddoch in 1917, who observed this carefully, and who was the man who described the so-called coitus reflex as part of the general mass reflex, and that is the explanation. That is something which we also have to consider, how far could we maintain and increase the erection reflex in the later stages, in spite of keeping the spasticity of the skeletal muscles as low as possible?

Now, Dr. Pearson's and Dr. Jousse's questions are very important. The first question, about the erogenic zones above the cord lesion. There is no doubt from all my observations and discussions with both the male and female partners, that they exist. Paraplegics are often not only embarrassed but sometimes afraid to talk to the doctor about their sexual relationship, and it is up to us to tell them that their sexuality is as important and may even be more important than other symptoms of their paraplegia. Once you have explained that to them, they will talk to you freely, and you might be able to help them. In cases of T₇, for instance, the erogenic zones of the nipples is even increased, and women by being touched or rubbed on the breast and nipples get a very pleasant libidinous feeling, and sometimes that sensation goes right down in the abdominal area, and some of them, although complete lesions, will tell you it goes right down into the vagina. This is an interesting observation, how the sensory afferent system above the transverse lesion can be involved in the rehabilitation of the sexual function. The same applies also to the males, and lesions below T₅, the zone of the chest of the man, if stimulated by the female partner can also arouse a libidinous sensation. All these things we learned from the patients and have utilised to instruct other patients.

The second question, which is a very important one, namely whether the sperms of paraplegics, either obtained spontaneously or by the prostigmine test, could be preserved. As you know, in the animal world, this is a very common thing to get sperms from good bulls, freeze and store them, and use them for insemination in cows. The spermal fluid is sent all over the world to get good cattle. So far medicine, unlike veterinary medicine, has not yet succeeded in this respect, but I am very glad that you asked that question because there is still a possibility if the cytological investigation shows a good result of motile sperms that future research may succeed in preserving such specimens for artificial insemination in man.

Another point I would like to mention is the fact that it is not only the paraplegic who is infertile. As you know, in many able-bodied people there are sometimes abnormalities in the female which prevents them from conceiving. Therefore, in all cases where artificial insemination is contemplated the wife has to be examined by a gynaecologist and also the best time of the insemination should be carefully chosen, not only with regard to rise of temperature but also the examination of the vaginal smear and pH might be of great importance in this respect.

Now I come to the question of Dr. Jousse, why there is a difference between the effect of prostigmine following oral or intramuscular injections as compared with intrathecal injections. Orally-given or intra-muscular injection of prostigmine has the opposite effect on the skeletal muscles—it increases the tone of the muscles, and that is the reason why it has been for many years a very important drug for the treatment of myasthenia gravis. Why intrathecal injection has the opposite effect, we just don't know, and that is a point where further biological research is necessary. It may be a specific pharmacological effect on different cells within the spinal cord, which on the one hand inhibits the reflex function of the skeletal system and on the other stimulates the reflex function

of the reproductive system resulting, during its increased action, particularly during the contractions of its efferent organs (vesicles, prostate, etc.) in a general hyperreflexia of other autonomic mechanism, especially of the high vascular system in cervical lesions.

The pH, as we found in the seminal fluid, varies between 7.5 and 8.5 whilst the vaginal pH is 4.5 to 5. Whether the seminal fluid of the spinal paralysed is lacking of bio-chemical substances, for instance, enzymes, which affect the motility and life-span of the semen and/or facilitate the destruction of the semen by the vaginal secretion is still unknown.

What Mr. Harris said is quite right, that intercourse, even in non-paralysed subjects who have something wrong in their vascular system, may have disastrous vascular effects including death. We must not forget that the autonomic reactions to stress are nothing abnormal, not only in intercourse but also blood pressure goes up, in labour and there is distension of bladder, etc. Only in the tetraplegic are the vascular responses abnormally exaggerated because of the vaso-constriction occurring over the greater part of the vascular bed as a result of the interruption of the sympathetic control in the paralysed part of the body. This has been described in detail already in my first publication on this subject in 1947 in co-operation with Whitteridge. Dr. Rossier in his excellent study and previously other workers have confirmed this including the cardiac changes. An X-ray of the heart taken during excessive autonomic hyper-reflexia may show an increase of the heart diameter up to 1.5 cm. The bradycardia is of course a very important symptom in all this and I agree with Dr. Rossier that we really don't know where the compensatory mechanisms to redistribute the blood resulting from the vasoconstriction are produced. As we suggested in our paper on vascular changes during labour (published in co-operation with Frankel and Paeslack in *Paraplegia*) apart from the carotis sinus, the autonomous innervation of the heart itself may be responsible for the bradycardia and other cardiac irregularities. There has been no aneurysma or other abnormality found in the brain of the tetraplegic who died. He had a ventricular haemorrhage. However, at necropsy an undiagnosed abscess behind the pancreas was found.

With regard to the catecholamines, Dr. Rossier's findings are very interesting but I think you should, if you have the opportunity, take blood and find out the catecholamine changes in the blood before, as well as during erection and ejaculations and also afterwards. That might be important, particularly from the point of view as to what happens first—the reflex changes or the hormonal changes.

Dr. Jousse asked how many patients were complete and how many incomplete. As I showed in the Tables of the 134 patients, 102 were complete and 32 incomplete.

Lastly I already pointed out that the majority of our patients who had the prostigmine test had infection of the urine. I have no doubt that the infection of the urinary tract itself must have an adverse effect on the fertility of paraplegics and tetraplegics. And, although we had some cases who were sterile they had had previous infection and this infection may have set up changes in the ejaculatory province. Actually some of the cases where we had no results at all previously had fistulae and abscesses in the testicular organs. Therefore, the more we succeed in preventing infection of the urinary tract the more, I hope we might improve, in future, the fertility of our patients.

Dr. A. ROSSIER (*Switzerland*). I would like to say one word about the question of Dr. Jousse. As you will see from the second table, the blood pressure came back to its normal value five hours after the last ejaculation took place. I think this is probably, as you said Sir Ludwig, because of a pharmacological effect, there is no other explanation I believe.

Now, your suggestion Sir Ludwig. Perhaps it was not quite clear in the second table of the examination of catecholamines that these have been made both in blood and urine, and they have been made during ejaculation for both adrenalin and noradrenalin assessment, but Dr. Siegler, who is doing this investigation in Zürich, found, as you know, the technique of assessment of catecholamines in the blood to be extremely

delicate. We therefore have purposely not given the proportions of adrenalin and noradrenalin in the blood although it has been made, but, as I said, we are not yet sure enough of the technique. Per contra, we are sure that we have the total catecholamine in blood and in urine.

Dr. H. TALBOT (*U.S.A.*). I have one or two comments. It is interesting to see that the thoracic T1 level repeatedly asserts itself in the observations of many of us both in respect to rather rigid neurophysiological observations and in respect to interviews and reports by the patients in the terms of their own capacities and sensations. Of course, it is absolutely essential in all of these matters when you are using any method of history-taking or interviewing to include both partners and this is not only of value to us in the accumulation of data, but it can be invaluable to the patient and his spouse or her spouse as the case may be, in helping them to develop a satisfactory conjugal relationship. With regard to the testicular biopsy which is, as has been pointed out, a not very satisfactory method for routine use, I should like to draw your attention to the fact that careful palpation will almost always give you results which are very closely correlative with testicular biopsies. A small, soft testicle is a real give-away, and if this is further confirmed by the palpation or a relatively small prostate it is quite safe to defer testicular biopsy, and a biopsy is not necessary except in those cases which you pursue for academic purposes. The fact remains that testicular biopsy is much less common now, it seems to me, than it was 20 years ago. The cystogram is so valuable as an indicator of dysreflexia that it should be an essential part of every examination of every patient and should be repeated from time to time. Originally devised in order to give us information of the bladder, I find in my service that we utilise the cystogram much more constantly in detecting and anticipating autonomic dysreflexia than in the matter of the bladder itself, and our cystometric record includes routinely recording of blood pressure with each increment of film reporting on autonomic phenomena, such as sweating, headache, and the like.

I should simply like to close by pointing out that although reproduction is the natural, biological consequence of sexual activity, I would like to point out that in our society only a very small proportion of our libidinous energy goes into reproduction, and that it does not seem to me justifiable in order to enable a patient to procreate to assume any risk by any procedure, however small that risk may be. Adoption is easy, adoption is, I think, one of the most enlightened and elegant forms of social culture, although it is not unknown in primitive cultures, and adoption as most of us know has been highly successful in a great majority of these people. Although we appreciate the desire of these people to become natural parents I think we must remember and remind ourselves constantly that there is a reasonably good substitute and that the insistence on natural parenthood is not worth, certainly not in my estimation, the risk of procedures which can be dangerous or adulterous.

Finally, it is interesting to point out that much of the misinformation which has pervaded society and eventually the medical profession about spinal cord injury patients and their impotence is derived not from medical sources but from a literary source, and I think it worth while to call your attention to this. That some 40 years ago a novel was written by a man who was a considerable novelist and a poet, D. H. Lawrence, and the name of the novel was *Lady Chatterley's Lover*. This novel was promptly banned, and it would now seem rather thin fare for high school children, and in consequence it was eagerly read by millions of people, and in the novel the male protagonist, Chatterley, was a World War I paraplegic. He was described as impotent by D. H. Lawrence, who, although a considerable poet and novelist, was no physiologist, and in consequence the occasion arose for Lady Chatterley to have a lover, and this picture of the impotent paraplegic pervaded society and pervaded medicine, and I am quite satisfied that it was responsible for much of this enduring misconception. I think it's time that we developed a novelist who wrote about a second and prolific paraplegic.