

MUSCLE PAINS THAT FOLLOW ADMINISTRATION OF SUXAMETHONIUM

BY

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Since Churchill-Davidson (1954) described a relationship between the administration of suxamethonium chloride and post-operative muscle pains, claims have been made for many methods of prevention. This paper describes an investigation of three such methods: (a) the use of the bromide salt of suxamethonium in fresh solution; (b) the administration of neostigmine and atropine after the return of normal respiration; and (c) the intravenous injection of a small dose of gallamine triethiodide prior to the suxamethonium in a group of out-patients. It also includes an assessment of the incidence of muscle pains in relation to age, sex, and site of operation after various surgical procedures in in-patients.

Method

The out-patients were an unselected group of patients who had bronchoscopy performed under general anaesthesia and who were sent home within four hours of the procedure. All received a questionnaire, one of the questions on which was: "Did you have any pain or weakness in your muscles the following day?" If the answer was in the affirmative, then a second questionnaire asking for more detailed information was sent (Churchill-Davidson, 1954).

The in-patients consisted of 289 consecutive patients who required intubation, which was performed after the administration of suxamethonium chloride. Anaesthesia was maintained with various inhalational agents.

The anaesthetic technique for all the out-patients was as follows.

Premedication.—Papaveretum hydrochloride, 10 mg., and hyoscine hydrobromide 0.425 mg., except for those patients over 60 years of age, who received atropine sulphate, 0.6 mg., instead of the hyoscine hydrobromide.

Anaesthesia.—Intravenous thiopentone, 200–500 mg., followed by a total dose of 60 to 225 mg. of suxamethonium. The larynx and trachea were sprayed with 4 ml. of 4% lignocaine and a No. 6EG oesophago-gastric tube was placed in the trachea with its tip at the level of the carina. Through this, oxygen at a rate of 3 litres a minute was administered throughout the bronchoscopy.

Results

The inquiry into the incidence of pain after use of the different methods gave the following results.

(a) Suxamethonium Bromide ("Brevidil M") Made up in Normal Saline Before Each Day's Cases

	No.	With Pain	Without Pain
Out-patients ..	32	59%	41%

These figures agree with Churchill-Davidson's results for this procedure using a similar technique with suxamethonium chloride.

(b) Atropine, 1 mg., and Neostigmine, 1 mg., Intravenously on the Return of Respiration

	No.	With Pain	Without Pain
Out-patients ..	64	55%	45%
In-patients ..	116	19%	81%

All the in-patients had a non-depolarizing relaxant after the initial return of respiration and prior to the injection of neostigmine.

These figures are not significantly different from those in section (a) or in the total of in-patients.

(c) Gallamine Triethiodide, 40 mg. Intravenously, Before Suxamethonium Chloride

	No.	With Pain	Without Pain
Out-patients ..	7	28%	72%

Gallamine Triethiodide, 20 mg. Intravenously, Before Suxamethonium Chloride

	No.	With Pain	Without Pain
Out-patients ..	38	36.8%	63.2%

The prior administration of gallamine triethiodide does significantly lower the incidence of muscle pains.

Of the 289 in-patients who received suxamethonium chloride 23.6% had pain and 76.4% had no pain.

Effect of Age, In-patients

	No.	With Pain	Without Pain
Below 27 years (average 21) ..	36	16.7%	83.3%
Over 63 years ..	63	12.7%	87.3%
" 70 " ..	12	Nil	100%

There were no patients at the extremes of age in the out-patient series. These figures show a reduction in the incidence of pain with increasing age.

Discussion

This investigation confirms the high incidence of muscle pains after the administration of relatively large doses of suxamethonium that has been reported by all workers who have investigated this common and often distressing complication of anaesthesia, and bears out the difference found between out-patients and in-patients (Churchill-Davidson, 1954; Hegarty, 1956).

In spite of the claim of Ruddell (1957), it was found that the use of a fresh solution of suxamethonium bromide had no effect on the incidence of muscle pains, and this is in agreement with the results of Leatherdale and his co-workers (1959). König (1956) found that the intramuscular injection of neostigmine, 0.5 mg., three-quarters to one hour after the examination, reduced the incidence of pains after bronchoscopy from 57% to 30%. But the present investigation failed to demonstrate any decrease in the incidence of pains when neostigmine was administered intravenously a few minutes after the bronchoscopy. This may be due to the failure of the motor end-plates to have returned to normal and to the fact that neostigmine produces a degree of neuromuscular block itself (Churchill-Davidson and Christie, 1959).

Of the methods used in this investigation in an attempt to reduce the incidence of muscle pains, only the prior injection of gallamine triethiodide shows a statistically significant improvement. Morris and Dunn (1957) found that, of the methods they tried, only the prior injection of 5 mg. of D-tubocurarine was effective.

The use of a non-depolarizing relaxant prior to the administration of a depolarizing agent, however, is not without danger: larger doses of the depolarizing agents are required to produce similar conditions to those obtaining when a non-depolarizing agent is not used, and difficulty may be experienced in the establishment of normal respiration particularly in patients for bronchoscopy.

In four of the seven patients who received gallamine triethiodide, 40 mg., prior to the suxamethonium chloride, respiration did not return as rapidly as was expected, and in one patient respiration was inadequate and required assistance for 10 minutes after the bronchoscopy had ended, and was adjudged to be adequate only after an intravenous injection of edrophonium, 10 mg., followed by neostigmine, 2.5 mg. This led to the abandonment of the use of such large doses of gallamine as 40 mg. The same criticisms can be applied to the use of 20 mg. of gallamine triethiodide, and, indeed, in one of these patients an injection of edrophonium, 10 mg., was required to return respiration to normal.

Hegarty (1956) noted a sex difference in the incidence of muscle pains, and this was confirmed by Leatherdale and his co-workers. The results of this investigation do not agree with their findings (see Table I). The

TABLE I.—Effect of Sex on Incidence of Muscle Pains

	Sex	No.	With Pain	Without Pain
Out-patients:				
Suxamethonium bromide ..	M	27	59%	41%
	F	5	60%	40%
Atropine and neostigmine ..	M	59	51%	49%
	F	5	100%	Nil
Gallamine triethiodide 40 mg. ..	M	5	20%	80%
	F	2	50%	50%
" " 20 " ..	M	31	35.5%	64.5%
	F	7	43%	57%
Total	M	122	47.5%	52.5%
	F	19	63%	47%
In-patients				
.. .. .	M	69	32%	68%
	F	220	21%	79%

difference in the out-patient series is not significant, though it is in the same direction, but the trend in the in-patients is in the reverse direction. This may be because the in-patients are unselected and other factors, such as age and site of operation, may be intervening.

Jackson Rees (1958, personal communication) and Ruddell (1959) state that post-operative muscle pains do not occur in children after the use of suxamethonium. The number of children in this series does not allow an accurate assessment of the incidence of pain, but in those below the age of 27 the incidence is low, but not significantly so. On the other hand, the incidence of post-operative muscle pain is significantly less in those over 60 years of age.

The incidence of muscle pains in relation to different operations is of interest (see Table II). Previous reports have been confined mainly to operations about the head and neck.

This investigation shows that a very high incidence occurs after investigational procedures and a low incidence after thoracotomy and upper abdominal

TABLE II.—Analysis of Results in In-patients in Relation to Sex and Site of Operation

Operation	Total No. Patients	With Pain		Without Pain		% of Total with Pain
		M	F	M	F	
Aortogram and air encephalogram ..	13	8	3	1	1	85
Thoracotomy ..	17	1	—	2	14	5.9
Upper abdominal ..	27	—	1	10	16	3.7
Lower " ..	90	—	22	13	55	24.4
Extremities ..	20	3	3	5	9	30
Remainder ..	122	10	17	16	79	22
Total	289	22	46	47	174	23.5

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operations, in the former the absence, and in the latter the severity, of the post-operative pain may be accentuated, and may mask the severity of the muscle pains due to suxamethonium.

The muscle pains that follow the administration of suxamethonium are a common complication of modern anaesthesia. Their incidence is related to age and to whether the patient is kept in hospital or sent home after the operation. This is probably equivalent to saying that the incidence is less if the patient rests after the procedure. The incidence can be reduced by the prior administration of non-depolarizing muscle relaxants, but this practice is not recommended.

Summary

The administration of suxamethonium bromide instead of suxamethonium chloride has no effect on the incidence of post-operative muscle pains in a group of out-patients.

The intravenous injection of atropine and neostigmine at the end of the bronchoscopy has no effect on the incidence of muscle pains.

Gallamine triethiodide administered intravenously beforehand in a dose of 20 mg. lowers the incidence and severity of the pains but is liable—particularly in patients for bronchoscopy—to cause respiratory difficulties at the termination of the bronchoscopy.

After the administration of suxamethonium chloride to in-patients, nearly a quarter suffer from post-operative muscle pains, the incidence being less at the extremes of age and after certain operations.

Every time suxamethonium is used consideration must be given to the indications for its use and the incidence of muscle pains afterwards, and we must all hope that the chemists will produce a new relaxant with the advantages of suxamethonium but without its capacity for producing these pains.

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Over a million tons of smoke are emitted yearly from domestic fires, compared with half a million tons from industry and 100,000 from the railways. On the other hand, domestic chimneys contribute only 100,000 tons out of the 900,000 tons of grit and dust that are emitted. These are the two main forms of pollution with which the Clean Air Act is concerned. Sulphur dioxide gas, given off from all solid fuels and fuel oils, totals 5½ million tons, to which domestic fires contribute nearly a million tons. These are a few of the many facts about air pollution and the campaign for its prevention contained in the *Clean Air Year Book, 1960*, published by the National Society for Clean Air at 2s.