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RESOURCE UTILISATION ASSOCIATED WITH SINGLE DIGIT DUPUYTREN'S CONTRACTURE TREATED WITH EITHER SURGERY OR INJECTION OF COLLAGENASE *CLOSTRIDIUM HISTOLYTICUM*

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ABSTRACT

The gold standard treatment for Dupuytren's contracture is surgical excision of the cord. A non-surgical treatment with collagenase clostridium histolyticum injection is available but appears costly.

Objectives: To provide data on resource consumption related to surgical and non-surgical treatment for Dupuytren's contracture.

Design and Participants: Twenty patients with a single digit Dupuytren's contracture, 10 treated with surgical excision, and 10 treated with a single injection of collagenase.

Measurements: Minutes spent in theatre, number of follow-up appointments, time to skin healing, and patients return to normal activities of daily living.

Results: The injection group was significantly better regarding theatre time ($p < 0.0001$), follow-up appointments ($p = 0.048$), skin healing time ($p < 0.001$), and return to normal activities of daily living ($p = 0.02$) than the operated group.

Conclusions: There are significant personal and health economic differences between the two methods of treatment which may influence local choice.

Keywords: Resources; Dupuytren's Contracture; Surgery; Injection; Xiapex.

INTRODUCTION

The gold standard for Dupuytren's contracture treatment is surgical excision of the cord and the technique has for many decades remained the same. For the last decade collagenase clostridium histolyticum injection and manipulation under local anaesthetic has been available[1] and both short[2] and moderate[3] term outcomes have been shown to be successful. However the uptake of this method has been relatively modest in the United Kingdom (UK) despite the less invasive nature of the treatment methodology. One reason for the slow uptake in the UK of this new method, may be that the £ 650 price of one vial of collagenase *Clostridium histolyticum* sufficient to treat one cord is perceived to lead to a more overall costly treatment than traditional treatment with surgical excision. Chen *et al.*[4] made a simulated cost comparison based on the economic realities within the United States private healthcare system, of

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open partial fasciectomy and collagenase *Clostridium histolyticum* injection for Dupuytren's contracture and found that open partial fasciectomy was not cost effective but that the injection under certain circumstances could be. However, conclusions from a simulated North American private health care study may vary significantly in results from a study based on a UK patient-based reality with the national healthcare system. We therefore devised a prospective study to investigate the major cost component for patients with single digit Dupuytren's contracture, treated with day-case surgical excision or a single injection of collagenase *Clostridium histolyticum* followed by a manipulation under local anaesthetic in the clinic setting three days later.

METHODS AND MATERIALS

This study was undertaken within the specialist hand unit of a National Health Service (NHS) orthopaedic department in an inner city location in Great Britain. Treatment within the NHS is free at the point of care but salary compensation for loss of income due to treatment and sick leave varies depending on the patient's personal employment contract and rarely completely compensates sick absence.

Patients referred for treatment of Dupuytren's contracture were included in this study if they fulfilled the criteria similar to the JOINT I and II studies[3] and only had one finger involvement, index to little finger. All patients were offered a choice between conventional open excisions or a single injection of 0.56 mg collagenase *Clostridium histolyticum* administered in day surgery[5] followed by outpatient manipulation of the cord under local anaesthetic three days later. Prospective data was collected from 10 consecutive patients undergoing open fasciotomy and 10 consecutive patients undergoing collagenase *Clostridium histolyticum* injection (0.56 mg *C. histolyticum* collagenase (*Xiaflex*, Auxilium Pharmaceuticals) as a treatment for Dupuytren's contracture were followed. Our local audit and ethics committee had approved an audit comparing treatment with open surgery and collagenase *Clostridium histolyticum* injection for Dupuytren's contracture.

All patients were treated in our dedicated day surgery unit and were performed by the lead author. Surgical procedures were all performed under general anaesthetic and collagenase *Clostridium histolyticum* was injected without anaesthetic cover with injection placement and post-injection observation following the manufacturer's recommendation.[5] Since the manufacturer recommends observing patients for 60 minutes after collagenase *Clostridium histolyticum* injection due to the risk of developing anaphylactic shock, all the collagenase *Clostridium histolyticum* injections within this study were administered in our dedicated day surgery unit where post-injection observation was also carried out.

The collagenase *Clostridium histolyticum* treated patients were seen three days later in our outpatient department where they had a manipulation of the cord under local anaesthetic. After the manipulation they followed a similar rehabilitation programme as the open surgically treated patients involving provision of a night splint, custom-made by a hand therapist, supervision of mobilisation, and wound management on a needs basis.

The length of time spent in different areas of the hospital was collected from a combination of the patient's electronic patient record (admission and discharge time and date) and the hospital's surgical database (Galaxy) that records precise timings for all patient movements within different areas of the hospital. Patient demographics were collected from the hospital's electronic patient records. The laterality and type of operation performed was recorded from the hospital's surgical database (Galaxy), the operation note and confirmed by the inpatient discharge summary, a document completed by the discharging doctor, which is sent to the patient's general practitioner within 48 hours of discharge. Time to recovery of normal activities of daily living (ADL) function and time absent from work following treatment were gathered via telephone interviews with each patient within a three month period following their operation. Patient follow-up visits were recorded based on entries within the electronic patient records and all patients were followed-up until discharge from the Hand Clinic.

RESULTS

Table 1 shows the age, gender, occupation, and time absent from work (days, d) for patients in each treatment group. There was no statistical difference between the two groups. The majority of our patients were older men, either retired or working in an office environment.

Table 2 shows the time spent in different areas of the hospital. Recordings of time spent in the operating theatre were significantly different ($p < 0.0001$) with a mean of 12 minutes for the collagenase *Clostridium histolyticum* group

Table 1 Age, Gender, Occupation, Sickleave, Return to ADL.

Xiapex	Age	Gender	Occupation	Side	Time off Work (d)	Time to ADL (d)
1	58	M	Lift engineer	L	2	2
2	74	M	Retired	R	NA	1
3	66	M	Retired	L	NA	7
4	57	M	Retired	R	NA	14
5	78	M	Retired	R	NA	7
6	66	M	Retired	L	NA	2
7	68	F	Retired	R	NA	7
8	69	M	retired	L	NA	3
9	66	M	Electrician	L	2	5
10	87	M	Retired	L	NA	2
Mean	68.9				2	5
Open	**Age**	**Gender**	**Occupation**	**Side**	**Time off Work (d)**	**Time to ADL (d)**
11	46	M	Office based	R	7	42
12	68	M	Retired	L	NA	182
13	61	M	Retired	R	NA	42
14	68	M	Retired	L	NA	21
15	71	M	Retired	L	NA	28
16	36	M	Manager	L	0	35
17	50	M	Office based	L	0	42
18	80	M	Retired	R	NA	21
19	62	F	Retired	L	NA	28
20	64	M	Office based	L	28	42
Mean	60.6				8.75	48.3
Stat *t*-test	0.11				0.53	0.02

Notes: ADL: activities of daily living.

compared with a mean of 105 minutes for the operated group. In this study all collagenase *Clostridium histolyticum* patients were observed for 60 minutes following the injection in case of anaphylaxis, according to the manufacturer's recommendation and as a consequence there was no statistical difference in the immediate post-treatment recovery time. However, all collagenase *Clostridium histolyticum* treated patients were discharged the same day from the day-surgery unit compared with the open group where three patients required overnight stays and one patient remained an inpatient for two nights post-operatively due to slow anaesthetic recovery. As a consequence, the mean time spent in the post-operative ward was 0 and 630 minutes for the injected/operated groups respectively, a significant difference ($p = 0.05$), and the mean total time spent in the hospital was 194 minutes and 1009 minutes the injected/operated groups respectively, ($p = 0.01$).

Table 3 shows that although skin healing is not normally necessary in the collagenase *Clostridium histolyticum* treated group, two of the collagenase treated patients suffered skin lacerations on cord manipulation which healed within one week of treatment but that it took two weeks for skin to heal in all of the open fasciotomy patients, a statistically significant difference ($p < 0.001$). There was no difference between the groups in the number of consultations with the doctor but there was a mean of two more appointments in the operated group with the hand therapist after the intervention ($p = 0.032$).

Return to work was 6.75 days longer in the operated group but as many in both groups were retired or worked in an office environment this difference was not statistically significant. However, the return to normal activities of daily living was 43 days longer in the operated group, a significant difference ($p = 0.02$), Table 1.

Table 2 Theatre and Hospital Time.

	Collagenase Injection Patients										
Hospital Locations	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Mean Time**
Pre-operative, pre-anaesthetic time (mins)	60	172	156	61	117	155	91	161	100	88	116.1
Anaesthetic preparation time (mins)	1	1	0	1	0	1	1	1	0	2	0.8
Theatre time (mins)	16	13	9	14	6	11	19	11	12	12	12.3
Recovery time (mins)	62	61	64	25	45	147	93	28	68	58	65.1
Post-operative ward time (mins)	0	0	0	0	0	0	0	0	0	0	0
Total time	140	249	232	105	173	320	211	209	189	170	194.3
	Open Fasciectomy Patients										
Hospital Locations	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**Mean Time**
Pre-operative, pre-anaesthetic time (mins)	209	215	156	229	193	30	88	136	129	141	152.6
Anaesthetic preparation time (mins)	5	5	0	1	5	5	5	1	2	24	5.3
Theatre time (mins)	84	126	145	109	76	84	120	176	77	60	105.7
Recovery time (mins)	316	60	120	141	51	60	129	75	87	109	114.8
Post-operative ward time (mins)	0	994	179	0	155	2761	0	917	59	1243	630.8
Total time	614	1400	600	480	480	2940	342	1305	354	1577	1009.2

Statistics	***p*-Value**
Pre-operative, pre-anaesthetic time (mins)	0.14
Anaesthetic preparation time (mins)	0.07
Theatre time (mins)	< 0.001
Recovery time (mins)	0.09
Post-operative ward time (mins)	0.05
Total time	0.01

DISCUSSION

Our results show that there are substantial and significant differences in the type of resource consumption that the two very different treatment methods require in order to treat a patient with single digit Dupuytren's contracture. How such resources are priced may vary greatly between different health trust accountancy systems and will influence whether the £ 650 cost of the drug makes either the surgery or injection method preferable or indeed similar on a purely financial basis. The total calculation of cost for the two methods did not lead to a statistical difference for our department but we appreciate that internal cost calculation may be very different in other hospitals/health economies. For that reason we have provided a detailed breakdown for each patient of the time spent in different hospital locations throughout their treatment (Table 2) as this may facilitate exact individual cost calculations in different institutions. Similarly, we have listed the number of follow-ups both with doctors and hand therapists allowing for local cost calculations (Table 3). Because of the significant difference in time spent in the theatre between the two groups, cost for theatre time and post-operative recovery time will be the most likely single financial determinant as to whether there is a preference to treat Dupuytren's contracture with the collagenase *Clostridium histolyticum* or open surgery. For the purpose of this study all the patients undergoing collagenase *Clostridium histolyticum* injection were treated in our day surgery unit due to the issue of supervision after the injection if they were to develop an anaphylactic reaction,[5] however, there is no medical reason why injections and supervision could not take place in an outpatient department and thereby further release expensive theatre resources related to those patients who choose injection treatment rather than surgery.

Though the indirect cost to the patients through sick leave and inability to carry out activities of daily living do not influence the hospitals' budget calculations, it would be reasonable for commissioning bodies to give some consideration to the total socio-economic impact of different treatment methods if these have significantly different implications on the patients

Table 3. Skin Lasseration/Healing, Follow-up Appointments.

Xiapex Number	Lasseration	Healed	FU Doctors	FU OT	FU Total
1	0	0	3	4	7
2	0	0	5	6	11
3	1	7	2	2	4
4	0	0	4	3	7
5	0	0	5	6	11
6	1	7	3	2	5
7	0	0	2	1	3
8	0	0	2	7	9
9	0	0	1	2	3
10	0	0	3	5	8
mean	0.2	1.4	3	3.8	6.8
Open Number	**Lasseration**	**Healed**	**FU Doctors**	**FU OT**	**Total**
11	1	14	3	5	8
12	1	14	3	9	12
13	1	14	4	3	7
14	1	14	3	4	7
15	1	14	4	6	10
16	1	14	3	7	10
17	1	14	3	8	11
18	1	14	5	6	11
19	1	14	3	5	8
20	1	14	3	5	8
mean	1	14	3.4	5.8	9.2
stat t-test $p =$	< 0.001	< 0.001	0.41	0.032	0.048

post-treatment lifestyles. Such lifestyle implications may also lead to a direct expense for the patients, which may also lead to social care resource consumption. We have therefore recorded important factors that may lead to an expense to the patients such as time taken to skin healing, time absent from work, recovery time to normal activities of daily living, and the number of hospital appointments after treatments. The actual cost to the individual patient or the social care provider will vary depending on whether they are retired, as many were in our study, their occupation and the social benefits they enjoy if absent from work etc, and we have therefore provided the raw data to allow individual patients a more informed choice on the best treatment modality according to their personal circumstances. By comparing 10 consecutive patients with single digit Dupuytren's contracture treated with open surgery with 10 consecutive patients with single digit Dupuytren's contracture treated with a single collagenase *Clostridium histolyticum* injection episode, we have found that the recovery time for the collagenase *Clostridium histolyticum* group was significantly faster than for patients treated with open surgery and that none of the collagenase *Clostridium histolyticum* treated patients needed to stay in hospital overnight compared with four of 10 operated patients.

In summary, cost comparison between the two methods will depend on what the manufacturer charges for collagenase *Clostridium histolyticum*, the cost of the theatre time, ward recovery time, and the proportion of operated patients who can be discharged following day-case surgery. Cost calculation based on our hospital's inter-departmental charges show that the mean cost for single digit surgery is higher than single digit collagenase *Clostridium histolyticum* treatment, though the differences are not statistically significant. We believe these results can assist in local evaluation as to what treatment methods should be made available to the surgeon and their patients.

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