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MAIN ARTICLE

Economic impact of recurrent respiratory papillomas in a UK adult population

A HARRISON[1], J MONTGOMERY[2], F B MACGREGOR[3]

[1]*Department of Otolaryngology, North Manchester General Hospital, Pennine Acute Trust,* [2]*Department of Otolaryngology, Queen Elizabeth University Hospital, Glasgow, Scotland, and* [3]*Department of Otolaryngology, Gartnavel General Hospital, Glasgow, Scotland, UK*

Abstract

Objective: To calculate the financial burden of recurrent respiratory papilloma. This study is UK-based, where up until now no financial estimates have been calculated for this group of patients.

Background: Recurrent respiratory papilloma is caused by the human papilloma virus (subtypes 6 and 11). The burden for the patient and the healthcare system is significant given the recurrent nature of the disease.

Methods: Data were collected, using a questionnaire completed during routine clinical follow up, from a single centre managing recurrent respiratory papilloma in Glasgow, Scotland. Cost information was sourced from the Scottish Government's Information Services Division.

Results: Fourteen patients with active recurrent respiratory papilloma between 2013 and 2014 were identified. The direct measurable cost to NHS Greater Glasgow and Clyde amounted to £107 478.

Conclusion: Recurrent respiratory papilloma is a benign condition, but the financial implications of diagnosis are significant. Recurrent respiratory papilloma has a natural history of relapse and remission, and patients may require healthcare input over a period of several years.

Key words: Papilloma; Human Papillomavirus Recombinant Vaccine Quadrivalent, Types 6, 11, 16, 18; Recurrent Respiratory Papillomatosis; Cost Of Illness

Introduction

Laryngeal papillomatosis is part of the disease spectrum of recurrent respiratory papilloma. The latter was first described in the late 1800s by Sir Morrell McKenzie.[1] A century later, human papilloma virus (HPV) was identified as the causative agent of recurrent respiratory papilloma. Subtypes 6 and 11 are most common in this disease. The adult-onset incidence of recurrent respiratory papilloma is quoted as ranging from 0.24 to 4.3 per 100 000.[2]

The mean age at diagnosis in an adult population is 26 years.[3] These patients are from the working demographic. Recurrent respiratory papilloma has the potential to cause considerable economic burden, to the individual and to wider society, for repeated hospital appointments, day-case admissions for surgical procedures and added recovery time. In addition to the financial impact of recurrent respiratory papilloma, voice use quality,[4] emotional health and overall quality of life[5] can deteriorate. The economic cost of managing recurrent respiratory papilloma has previously been estimated in the USA at $150 million annually,[2] but there are no comparable UK data.

Current surgical management includes laser excision or ablation and microdebrider reduction. Intralesional injection (with medications such as cidofovir[6]) and systemic treatments are not used widely in the adult population, which is in contrast to therapy in the paediatric population. Systemic options include interferon,[7–9] acyclovir[10] and retinoic acid.[11]

More recently, vaccinations against HPV have been introduced, including the quadrivalent vaccine Gardasil (Merck, Kenilworth, New Jersey, USA). The vaccine is active against HPV strains 6, 11, 16 and 18. While its role in recurrent respiratory papilloma is not well established, it has been shown to be effective in the prevention of pre-cancerous diseases caused by HPV subtypes 16 and 18.[12] The use of Gardasil is prophylactic against the development of recurrent respiratory papilloma, and although hypothesised to have potential for therapeutic intervention, this has not been proven (Montgomery *et al*., unpublished data).

This study aimed to calculate the financial burden of recurrent respiratory papilloma in a cohort of adults based in the UK. The setting of this study is a single

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centre (Gartnavel General Hospital) in Glasgow, Scotland. All patients were undergoing active treatment for recurrent respiratory papilloma in a snapshot period of one year (2013–2014), and were under the care of the senior author, who has a specialist interest in managing voice disorders.

Materials and methods

Demographic data were anonymously collected on all patients undergoing active treatment for recurrent respiratory papilloma between January 2013 and April 2014. These patients attended a specialist voice clinic at Gartnavel General Hospital (which has a core catchment of 560 000 patients), NHS Greater Glasgow and Clyde, in Glasgow.

Economic information on hospital costs was collected from the online database of the Information Services Division Scotland.[13] The Information Services Division is part of NHS Scotland; it is an online database that provides information on statistics, health and quality improvement. It is an official body of the Scottish Government, and the information is freely accessible to all.

The Information Services Division database was used to calculate overall costs of out-patient clinic appointments, operating theatre times, and speech and language reviews. The cost of any pharmaceuticals used, such as mitomycin and Gardasil vaccination, were calculated from information provided by the local pharmacy and the British National Formulary.[14] Patient data regarding surgical treatment, time missed from work and occupation were collected using an anonymous questionnaire during a routine clinical appointment (Appendix 1). The local speech and language department collated the data regarding speech therapy appointments.

Ethical considerations

This paper is a cost calculation reflecting the financial implications of recurrent respiratory papilloma. Patient data regarding treatment was anonymously collected using a questionnaire. The paper is a clinical effectiveness study rather than a clinical study, hence formal ethical approval was not sought. However, the study was registered with the clinical effectiveness department.

Results

Fourteen patients were identified (eight females and six males). The mean age at diagnosis was 36 (range of 12–66) years. Twelve patients were in full-time employment (one was self-employed). Details of employment are provided in Table I. One patient was retired from full-time work and one was a school student. None of the patients were active smokers, although 5 out of 14 (36 per cent) were ex-smokers. These patients were employed in a wide variety of jobs (Table I) demanding various amounts of vocal requirements.

TABLE I
PATIENT DEMOGRAPHICS

Pt no.	Age at diagnosis (y)	Occupation	Gender	Smoker?
1	25	IT analyst	M	No
2	33	Booking officer	F	No
3	32	Plumbing merchant	M	Ex
4	41	Joiner	M	Ex
5	66	Retired	F	No
6	42	Sales manager	M	No
7	21	Accountant	F	No
8	52	Graphic designer	M	No
9	30	Doctor	F	No
10	32	Naval officer	M	No
11	42	Policeman	M	Ex
12	12	School student	F	No
13	42	Self-employed utilities consultant	M	Ex
14	41	Musical theatre teacher	F	Ex

Pt no. = patient number; y = years; IT = information technology; M = male; F = female

Time off work is dependent on the nature of the employment and the individual, but was calculated using half a day for clinics and 8 days for surgery including operating theatre days. Eight days was chosen as patients are advised to adhere to strict voice rest for 2 days, followed by minimal voice use for 5 days. Until normal voice use is established, attending their usual employment may be difficult for many patients. The total number of days missed from employment or education ranged from 17 to 161.5 days following diagnosis.

The numbers of clinic visits, speech and language therapy sessions, and operative procedures are listed in Table II, along with their associated costs to the National Health Service (NHS).

At the time of writing (November 2015), an out-patient clinic visit cost £109 and a day-case microlaryngoscopy cost £1073. The recurrent respiratory papilloma patients underwent between 2 and 17 (mean of 6.14) surgical interventions. Ten patients received mitomycin application at surgery, costing £25. Seven patients completed HPV vaccination with a full course (three doses) of Gardasil, at a cost of £259.50.[14] The mean length of hospital follow up and treatment was 6.6 (median of 1.5, range of 1–10) years.

The total gross cost per attendance for speech therapy in Greater Glasgow and Clyde was £76.[3] One patient was treated privately and one was treated in a different centre so these speech and language therapy costs are not included.

The total cost (operating theatre time, clinic, pharmacy, and speech and language therapy costs) for the 14 patients over the time observed, from 2013 to 2014, was £107 478. Operating theatre costs make up the majority of these costs, totalling £92 828 for the 14 patients in our cohort. This cost is likely to be an underestimation and oversimplification of the financial

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TABLE II
NUMBERS OF CLINIC VISITS, OPERATIVE PROCEDURES, AND SPEECH AND LANGUAGE SESSIONS

Pt no.	Clinic visits* (total *n*)	Treatment period	Total clinic cost (£)	Microlaryngoscopy procedures* (total *n*)†	Total operating theatre cost (£)	SLT sessions‡ (total *n*)	Total SLT cost (£)	Vaccine?	Total cost to NHS so far** (£)
1	4	2013–2014	436	2 (2)	2196	1	76	Yes	2708
2	7	2011–2014	763	4 (1)	4317	Different hospital	N/A	No	5080
3	4	2012–2013	436	3 (1)	3244	0	0	No	3680
4	16	2003–2013	1744	16 (4)	17 268	0	0	Yes	19 012
5	15	2009–2013	1635	8	8584	0	0	No	10 219
6	11	2012–2014	1199	6 (3)	6513	Private	0	Yes	7788
7	20	2007–2013	2180	17 (4)	18 341	7	532	Yes	21 053
8	6	2012–2014	654	6 (1)	6463	5	380	No	7497
9	3	2012–2013	327	4 (2)	4342	3	228	Yes	4897
10	4	2013	436	4 (2)	4342	0	0	Yes	4778
11	6	2011–2012	654	4	4292	0	0	No	4946
12	4	2013–2014	436	2	2146	1	76	Due at school	2658
13	9	2008–2013	981	7 (2)	7561	17	1292	Yes	9834
14	1	2013	109	3	3219	0	0	No	3328
Total cost (£)			11 990		92 828		2660	1816.50	107 478

*Up to April 2014. †Values in parentheses indicate the number of cases where topical mitomycin was used. ‡Therapy only. **Cost does not include vaccine. Pt no. = patient number; SLT = speech and language therapy; NHS = National Health Service; N/A = not applicable

burden of recurrent respiratory papilloma. The operating theatre cost, taken from the Information Services Division database, includes medical staff, nursing staff, allied health professionals and operating theatre use costs, but may not include specific individual equipment costs.

Discussion

Although recurrent respiratory papilloma is generally a benign condition, the implications of a diagnosis are significant. The disease burden for patients includes regular clinic appointments, surgical interventions, and time off work, both for hospital appointments and during periods of symptom exacerbation (dysphonia). A recurrent respiratory papilloma diagnosis can lead to many years of costly therapeutic interventions within the NHS.

The Gartnavel General Hospital voice clinic has attempted to reduce costs to both the individual and the hospital by reducing the number of routine hospital visits. Once patients are familiar with the condition and understand their symptoms, they can contact the department when their voice is deteriorating rather than waiting to attend their routine follow-up appointment.

The post-operative voice rest period has been adapted and reduced so that individuals can often work in a reduced capacity while recovering from surgery. While no agreed local protocol exists, patients are generally advised to rest their voice for up to 48 hours post-operatively, and to use it sparingly for a further 5 days. The departmental speech and language therapists are trained to offer emotional support. They can maintain contact with patients over the longer term by e-mail or telephone to avoid extra hospital visits. In this cohort, there would be significant implications to the musical theatre teacher, the sales manager and the policemen associated with this condition. The self-employed patient found himself unable to work at all on occasion, resulting in financial issues. The naval officer was a submariner who was unable to join his vessel for longer tours.

Ultimately, the aim is to develop a treatment for recurrent respiratory papilloma that affects the disease itself, rather than managing symptoms as they develop. The current mainstay of treatment is surgical debridement of the lesions to maintain the airway and improve the voice. The introduction of Gardasil for school-age children may be a long-term preventative measure. Currently in the UK the vaccination is only offered to school-age females. Vaccination of both genders may reduce the prevalence of HPV in the population, which has benefits over treating already established recurrent respiratory papilloma.

In this cohort, patients needed to take time off work for clinic appointments and repeated surgical interventions, all of which may have had a significant detrimental effect on their financial welfare. There is a corresponding financial burden to the NHS, which is of particular importance given the current financial climate of austerity. Costs vary depending on the procedure undertaken (laser or microdebrider) and on the particular NHS trust concerned. There is some evidence to suggest that the use of a microdebrider is more cost effective than a laser.[15]

Prevention of recurrent respiratory papilloma, especially in the current economic climate, is important. Reduction of the associated symptoms may improve

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work attendance, and may also reduce the number of days missed for admission to hospital and post-operative recovery.

The social impact of laryngeal disorders on patients has been studied previously.[16] Although the disease was not specifically recurrent respiratory papilloma in that cohort, it can be inferred that dysphonia has a negative impact on quality of life. The authors, who presented evidence from American healthcare systems (hence the results cannot be directly compared to our findings), concluded that the cost impact of treating these patients was high and far-reaching.

The data have in part been collected retrospectively, which may result in some inaccuracies. It is difficult to establish the real individual economic costs incurred by patients through loss of work, and the effects of loss of voice on self-confidence and ability to perform well in employment. In Denmark, a national HPV vaccinated population cohort study confirmed a reduction in the risk of genital warts in girls.[17] The paper also mentioned the benefit this may have on the economic burden of treating recurrent respiratory papilloma over time. Studies on the economic burden of HPV strains 6 and 11 in genital warts have been conducted in both the UK and the USA. The results suggest an annual cost of around £31 million ($54 million) in the UK.[18]

The present study is limited by the fact that it comprised only a small number of patients, all from a single centre. Recurrent respiratory papilloma is a rare disease, and gaining further information would require multicentre studies. The quoted operating theatre costs do not include any potential overnight hospital stays, whether for social or clinical reasons, and do not include the use of specific operating theatre surgical or anaesthetic equipment.

- **Recurrent respiratory papilloma is a benign condition that requires holistic multidisciplinary team management**
- **It has significant financial and social implications for the National Health Service (NHS) and individual patients**
- **In this study, time off work for follow-up appointments and surgical procedures ranged from 17 to 161.5 days following diagnosis**
- **The total cost to the NHS for 14 patients was £107 478, although this is likely to be an underestimation**

This is the first paper to review the specific patient and healthcare costs associated with recurrent respiratory papilloma management in adults in the UK. This represents a significant financial burden, both to society and to the NHS. Early focused research into prevention of the condition could have benefits for the individuals and the NHS as a whole.

Conclusion

Recurrent respiratory papilloma treatment is holistic, involving clinical out-patient review, surgical time, and allied input from the speech and language department. All these services are time-consuming and costly. It is difficult to quantify the personal cost for an individual, as this varies with personal economic status. Furthermore, the burden of multiple hospital visits and time missed from work, and the burden to social activities, secondary to a benign condition, should not be underestimated.

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Appendix 1. Laryngeal papillomatosis quality of life and voice symptom scale (VoiSS)

Patient sticker

Age at diagnosis:
Occupation:

SLT input? Y/N

Time from diagnosis to first surgery:

Procedure 1 (type of scope, mitomycin used?):
Date of next procedure (2):
Date of next procedure (3):
Date of next procedure (4):
Further procedures:

Gardasil vaccine? Y/N
Date of vaccines: (1) (2) (3)
VoiSS score and date:
1.
2.
3.
4.

SF-36 score and date:
1.
2.
3.
4.

Papilloma staging:

Address for correspondence:
Miss Anna Harrison,
Department of Otolaryngology,
North Manchester General Hospital,
Delaunays Road,
Manchester M8 5RB, UK

Fax: 0161 778 3646
E-mail: annaharrison1@nhs.net

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