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## Review

# Analysis of the surgical management of skin cancer in the nonagenarian population: Twenty-five year data analysis from a single centre

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## ABSTRACT

**Background:** There were 142,101 new cases of non-melanomatous skin cancers reported by the UK National Cancer Statistics in 2015. The UK statistics published that the incidence is highest in the 90+ population and that this represented an overall 61% increase in skin cancer incidence in the UK in the last decade. This article aims to first provide an understanding of the change in service requirement over the last 25 years for skin cancer management in nonagenarians, and second, understand the subtypes of skin cancer and possible differences in the management for this cohort.

**Methods:** All skin cancer biopsies received by a UK university teaching hospital dermatology-histopathology department were analysed over a five-year period spanning 2013–2017. This was compared with snap shot data at five-year intervals dating back to 1993. The patient demographics including age, sex and anatomical region were seen along with the types of skin cancers and histological subtypes.

**Results:** A total of 1050 skin cancers were managed with surgical input between January 2013 and December 2017 in 733 patients. The number of biopsies/year has increased 7-fold from 1993 (33) to 2017 (231). The annual cost of the surgical element to this service

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has dramatically increased, and in 2017, it was £220k compared to £33k in 1993.

*Conclusion:* Partly because of the ageing UK population, there has been a dramatic increase in the demand on the surgical service regarding managing skin cancers in those over the age of 90. There is a higher rate of incomplete excision in this population than that reported in the national British Association of Dermatologists (BAD) guidelines. Despite higher incomplete excision rates, there is a low re-operation rate in this population probably due to patient comorbidities affecting reconstructive options, patient preference and clinical decisions on surgical morbidity versus benefit.

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## Introduction

There were 142,101 new cases of non-melanomatous skin cancers reported by the UK National Cancer Statistics (ONS) in 2015; they published that the incidence is highest in the 90+ population and that this represented an overall 61% increase in skin cancer incidence in the UK in the last decade.<sup>1</sup> NHS England states that the clear majority of non-melanomatous skin cancers are managed surgically; there are no NICE guidelines for the surgical management of these cancers. Most surgical practices in the UK are managed using the British Association of Dermatologists (BAD) guidelines.<sup>2</sup>

The referral criteria for suspected malignant melanoma (MM) and squamous cell carcinoma (SCC) are stipulated by NICE guidance for recognition and referral of skin cancers, published in 2015, which recommends the use of the 2-week wait (2WW) pathway for both diseases. Basal cell carcinomas (BCC) without suspicious features should be referred routinely unless there is concern regarding the size.<sup>3</sup>

This article aims to first provide an understanding of the change in service requirement over the last 25 years for skin cancer management in nonagenarians, and second, understand the subtypes of skin cancer and possible differences in the management for this cohort.

Many patients in the nonagenarian population have co-morbidities and polypharmacy, which poses an increased surgical risk. It is widely reported that we have an ageing population with those >70 years costing the most for acute medical care.<sup>4</sup> It is also reported that above 85 years, this cost starts to decline,<sup>5</sup> and we have chosen to review the nonagenarian population to assess whether this theory holds true in skin cancer care.

The results of this study will be useful for future service planning as the nonagenarian and centenarian population continues to increase. ONS reported in 2018 that by 2027, 20.7% of the UK population would be over the age of 65 compared to 18.2% in 2017.<sup>6</sup>

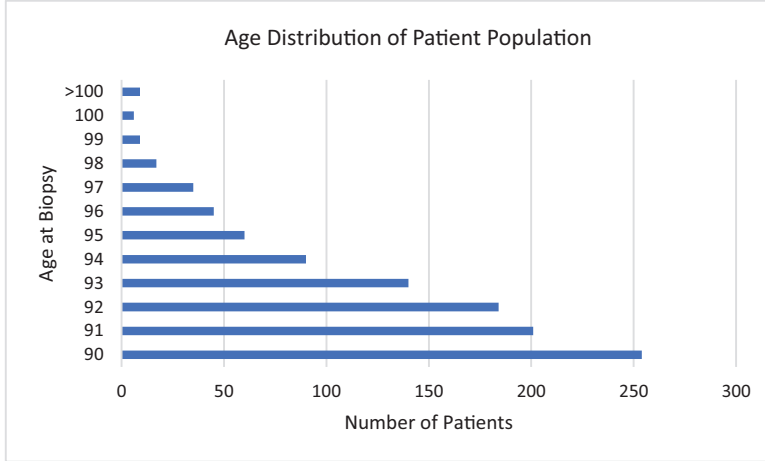
We are forced to consider the provision of the surgical service in managing skin cancer for these patients and how this can best be delivered to suit their needs. The continual closure of services at peripheral hospitals increases the travel requirement for this population. The lack of availability of same-day surgical intervention requires multiple visits. The authors call for a review in service planning for this need and propose an increase in same-day surgical lists and availability of peripheral services.

## Methods

Our data were provided by the specimen database within the histopathology department at University Hospitals of Leicester (UHL), UK. Data are recorded for each specimen received by the department.

**Table 1**  
Demographic summary of data.

Total Number of Patients	733	Male	376 (51%)
		Female	357 (49%)



**Fig. 1.** Age distribution of the pateint population (2013-2017).

We recorded the number of biopsies per year in 1993, 1998, 2003 and 2008, and then performed a more detailed analysis over a five-year period extending from 1 January 2013 to 31 December 2017 in patients aged 90 years and above, at the time of biopsy.

Data collected from this database included sex, date of birth, hospital number, specimen number, date of specimen collection and subtype of skin cancer (BCC/SCC/MM).

We undertook an in-depth analysis of all the specimens for a five-year period between 1 January 2013 and 31 December 2017 and cross-referenced all datasets with full histopathology reports on our Integrated Clinical Environment (ICE) computer software to confirm the subtype of BCC/SCC/MM and obtained additional data on surgical margins of excision. Data were input and analysed in Excel in a standardised way by senior trainees and consultants in plastic surgery.

We undertook a brief yearly analysis of data at 5-year intervals between 1993 and 2008. An immediate limitation was that we were not able to perform a more in-depth analysis in this dataset due to the unavailability of a unified pathology reporting system.

Estimation of costs to the department: The authors collated data on Clinical Commissioning Group (CCG) tariffs for the different stages of surgical management to understand the cost of service provision. The running cost of a local anaesthetic theatre is £1000 per hour. At Leicester Royal Infirmary, within the plastic surgery department, an average of five cases per 4 hours in the operating list are completed. Our new patient tariff is £62.00 per referral; follow-up appointments are charged at £47.00. These data were used to calculate the cost per lesion.

**Results**

We performed an in-depth analysis of data between January 2013 and December 2017. We summarised patient demographics over these 5 years (Table 1) with age distribution (Fig. 1). There was an even M:F ratio in 733 patients. We were able to ascertain whether excision biopsies were complete or incomplete and whether or not they proceeded to have further wide local excision.

A total of 1050 skin cancers were identified in 733 patients that had input from the surgical team. Some suspicious lesions underwent diagnostic biopsy via shave, punch, incision or curettage, while

**Table 2**  
Summary of skin cancers by histological subtype.

Skin Cancer	Number of Lesions
BCC	610
Basosquamous	6
Infiltrative	89
Micronodular	2
Mixed	8
Morpheic	2
Nodular	318
Noduloinfiltrative	124
Subtype not defined	5
Superficial	12
Superficial nodular	44
SCC	389
Bowen's Disease	9
Keratoacanthoma	3
Poorly differentiated	100
Moderately differentiated	191
Well differentiated	72
No subtype available	9
Undetermined range of differentiation	5
MM	51
Lentigo Maligna Melanoma	12
In situ melanoma	8
1–2 mm Breslow Thickness	3
>2 mm Breslow Thickness	22
Acral Lentiginous	3

**Table 3**  
Summary of samples by biopsy type.

Type of Biopsy	Number of samples	Number undergoing further surgery
Curette/Shave	7	0
Incisional/Punch	98	52
Excision	945	84

others had excision biopsy as first-line management. There were 610 BCCs, 389 SCCs and 51MMs (summarised by histological subtypes in [Table 2](#)).

The type of biopsy is summarised in [Table 3](#) with further detail about the number of patients undergoing further surgery after histological diagnosis from primary biopsy. None of the patients undergoing curette/shave biopsies had further surgery; these were BCCs (4) and SCCs (3). 53% of patients who underwent incision/punch biopsies went on to have further surgery ([Table 4](#)).

Of the 945 excision biopsies, 265 were incomplete (28%), and 84 of these incomplete biopsies went on to have further wide local excision. Incomplete was defined as any peripheral or deep margin breached by the tumour.

Incomplete excision rate of BCCs was 24% with 32 out of the 147 incomplete excisions going on to have further surgery. Further surgery was most common in morpheic (100%), superficial nodular (42%) and basosquamous (33%) subtypes but least common in micronodular (0%) and nodular (13%) BCCs. The anatomical area with the highest rate of incomplete excision was head and neck (118), 22% of which went on to have further surgery.

Incomplete excision rate of SCC was 27% with only 23 out of the 104 incomplete excisions going on to have further surgery. Further surgery was most common for moderately differentiated (29%) SCCs and for SCCs situated on the trunk (33%). The incomplete excision rate of SCCs (20%) in the head and neck area was comparable to the same in BCC subtypes (22%).

There were nine incompletely excised lentigo maligna melanomas; six underwent further surgery and three underwent topical therapy management (information from MDT reports). There single in-

**Table 4**  
Incomplete excision analysis by histological subtype and anatomical area.

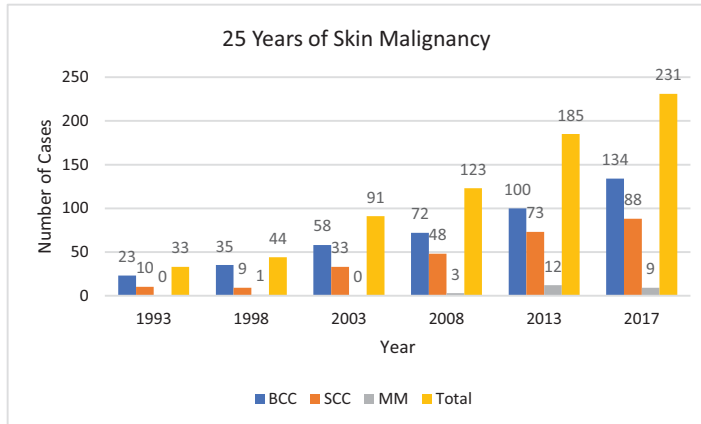
Incomplete excision by skin cancer type		Incomplete excision histology		Underwent Further Surgery		Anatomical Area		Underwent Further Surgery	
Basal Cell Carcinoma	Total 147 (24%)	Basosquamous	3	1 (33%)	H&N*	118	26 (22%)		
		Infiltrative	30	6 (20%)	LL**	16	6 (36%)		
		Micronodular	1	0 (0%)	Trunk	7	0 (0%)		
		Mixed	5	1 (20%)	UL***	6	0 (0%)		
		Morpheic	1	1 (100%)					
		Nodular	55	7 (13%)					
		Noduloinfiltrative	32	10 (31%)					
		Subtype not defined	3	0 (0%)					
		Superficial	5	1 (20%)					
		Superficial nodular	12	5 (42%)					
		n	147	32 (22%)	n	147	32 (22%)		
Squamous Cell Carcinoma	Total 104 (27%)	Bowen's Disease	3	0 (0%)	H&N	74	15 (20%)		
		Poorly differentiated	39	7 (18%)	LL	11	3 (27%)		
		Moderately differentiated	42	12 (29%)	SNR	1	0 (0%)		
		Well differentiated	16	3 (19%)	Trunk	3	1 (33%)		
		No subtype available	3	1 (33%)	Upper limb	15	4 (27%)		
		Undetermined range of differentiation	1	0 (0%)	n	104	23 (22%)		
		n	104	23 (22%)					
Malignant Melanoma	Total 14 (27%)	Lentigo Maligna Melanoma	9	6 (67%)	H&N	11	7 (64%)		
		In situ MM	1	1 (100%)	LL	2	1 (50%)		
		>2 mm MM	3	1 (33.3%)	UL	1	1 (100%)		
		Undeterminate	1	1 (100%)					
		n	14	9 (64%)	n	14	9 (64%)		

\*H&N = Head and Neck \*\*LL = Lower Limb \*\*\*UL = Upper Limb.

**Table 5**

Twenty-year snapshot of skin cancer in 90+ population (1993–2017).

Year	Total Lesions	BCC	SCC	MM
1993	33	23	10	0
1998	44	35	9	1
2003	91	58	33	0
2008	123	72	48	3
2013	185	100	73	12
2017	231	134	88	9

**Fig. 2.** The increase in skin cancer cases over a 25 year period.

completely excised in-situ melanoma which was excised with a further 1 cm margin. There were two MMs with a Breslow thickness of  $>2$  mm incompletely excised, and they did not have WLE as the patients passed away before planned surgery. The further surgery rate therefore is unsurprisingly significantly higher in the MM group (63%).

Where multiple lesions were excised at different occasions or during the same theatre admission, histology showed BCC and SCCs. There were three patients who underwent excision of two separate MMs at different sites.

The number of biopsies per year from 1993 to 2017 in 5-year intervals is presented in [Table 5](#) and [Fig. 2](#). This shows, in the context of an ageing population and with the advent of the NICE 2WW referral for skin cancers (2015), an overall increase in the incidence of skin cancer managed surgically in those over the age of 90, and a dramatic increase specifically in MMs.

As mentioned in our methodology, we calculated the average cost per patient undergoing local anaesthetic excision. The average cost per lesion is £906.00, and the details of calculations are presented in [Table 6](#). [Fig. 3](#) shows how the cost of surgical management of skin cancer in this population has changed.

## Discussion

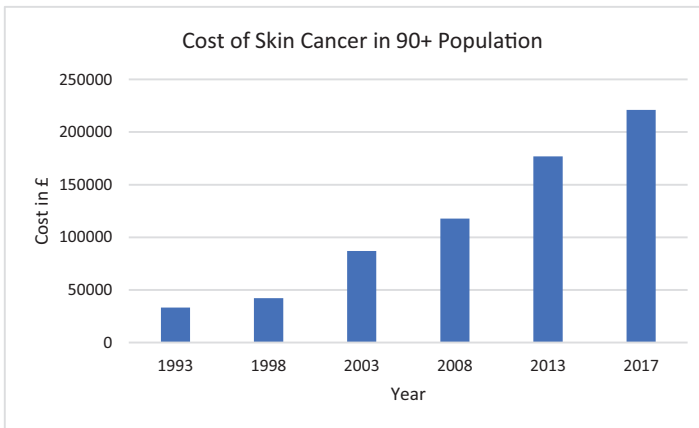
Among our UK ageing population, we are anticipating a further increase in the nonagenarian and centenarian population, which will have impact on various services providing healthcare to this population. Skin malignancies have the highest incidence in the over 65 years' age group according to the Office of National Statistics (ONS).<sup>6</sup>

In this study, we have shown a clear evidence of a 7-fold increase in the requirement for surgical inputs in managing skin cancers in the nonagenarian and centenarian groups ([Table 5](#) and [Fig. 2](#)). We

**Table 6**

Summary of surgical costs per lesion excised.

Episode	Cost	Explanation
New patient appointment	£62.00	New patient appointment after 2WW referral or referral from other speciality
Surgical treatment	£750	£1000 ph of local anaesthetic operating time. Most patients undergo local anaesthesia and theatre list planning allows for up to 45 min to account for help with mobility, confusion, anti-coagulants and other comorbidities.
Dressings follow-up	£47.00	Dressing change, removal of sutures or wound check. May be outsourced to community.
Outpatient follow-up	£47.00	Outpatient clinic review to explain histology results and the need for follow-up/further treatment.
Re-operation and further follow-up	£844	Further surgery and two follow-up appointments in 6% of cases between 2013 and 2017.

**Fig. 3.** Summary of cost of skin cancer in 90+ population including the cost of 6% re-operation rate.

have also shown the dramatic increase in cost to Care Commissioning Groups (CCGs) of this service, from £33k in 1993 to £220k in 2017. In addition to the ageing population, the advent of NICE guidelines and the 2WW system encouraging referral of skin cancers into secondary care undoubtedly has impact on the increase in skin cancers seen in our unit.<sup>2</sup>

Our service has grown to accommodate this change in requirement with the appointment of two skin cancer nurse specialists performing uncomplicated diagnostic and excision biopsies. We have also appointed an additional dermatology consultant and plastic surgery consultant with special interest in skin. Despite these adjustments, we are seeing an increase in the need for extra sessions to meet the 2WW targets for both clinics and operating services. Recent data presented at our local Skin Cancer Annual General Meeting has demonstrated the addition of weekly four to five out-of-hour parallel clinical sessions consulting over 70 patients referred via the 2WW system.

Based on the ONS prediction by 2027, there will be a further 2.7% increase in the over 90 population, resulting in an even bigger demand on services that are already stretched. In some units, same-day clinic appointment and surgery has helped to alleviate these pressures to a degree, but the fact remains that patients over the age of 90 years could be required to make a 120-mile round trip three times for the management of a simple non-life-threatening BCC in some areas of the UK.

Much of the incomplete excisions were in the head and neck area (203 out of 265 biopsies), and of higher risk histological subtypes (nodular-infiltrative BCCs, poorly/moderately differentiated SCCs, lentigo maligna melanoma and MMs). This may reflect the clinician or patient's preference for a simple excision and direct closure rather than a more complex flap or graft, which may necessitate longer

operating time, general anaesthesia and / or multiple trips to hospital for follow-ups. It is well known that trying to avoid the need for reconstruction can compromise surgical margins, and this may be an example of that. It has also been shown that local anaesthesia greatly reduces morbidity in the nonagenarian population and this may reflect a preference for that.<sup>7</sup>

This drawback of surgery calls the consulting surgeon to consider other treatment options based on the patients' status. In such cases, hypo-fractionated radiotherapy would improve effectiveness as well as decrease the toxicity associated with the treatment.<sup>8</sup> While surgical resection can be safe, effective and associated with an improved quality of life,<sup>9</sup> this may also reflect patient preference to not go through a second surgical procedure.

This study has a limitation of not being able to further investigate the impact of comorbidities, patient mobility and, in some cases, cognitive decline and their effect on clinic and theatre utilisation. We have assessed the nonagenarian and centenarian age group only<sup>10</sup>; however, under 90-year olds with similar circumstances can also have significant impact on service utilisation.

Our study highlights the need for planning service provision for the future at UHL. While upholding the highest standards of care possible for this cohort, we must also remain practical on what is best for the patient holistically.

## Conclusions

Our study presented an overview of a 25-year surgical service in the skin cancer management for those over the age of 90. We have shown a seven-fold increase in skin malignancies requiring surgical input, a high incomplete excision rate and a low re-excision rate in those with incomplete margins. This article calls the field to evaluate the current set up of surgical services to accommodate this population and consider same-day operations and availability of peripheral hospital clinics and operating lists. A national database to record skin cancer incidence (similar to IBID) may be useful. We would also advocate the use of tele-medicine follow-ups within primary care practice (a general practitioner with specialist interest in dermatology); this could reduce the need for elderly patients to travel into hospital.

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## Ethical approval

Not required.

## Declaration of Competing Interest

We declare no conflict of interest. No funding was required for this project. No ethical approval was required for this article. All the above authors contributed to this article.

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