

# Linear basal cell carcinoma: a distinct condition?

F. Al-Niaimi and C. C. Lyon\*

Department of Dermatology, Salford Royal Hospital Trust, Salford, Manchester, UK; and \*Department of Dermatology, Scarborough General Hospital, Scarborough, UK

doi:10.1111/j.1365-2230.2010.03908.x

## Summary

Linear basal cell carcinoma (BCC) was first reported as a distinct condition in 1985. Having managed two cases recently, we reviewed the published literature on this condition. The aim of the study was to review all reported cases in the literature and summarize the demographic data, histological and clinical features, and treatment methods used. We conducted a literature search from 1985 to 2008 for all published articles on linear BCC [PubMed (National Library of Medicine, Bethesda, MD, USA)] using the keywords 'linear' and 'basal cell carcinoma'. In total, 37 cases of linear BCC in 15 papers were reviewed. There was an equal male : female ratio in the cases. The periocular skin and the neck were the sites most frequently involved. Although the nodular pattern was the commonest histological feature reported, there was a relatively high percentage of infiltrative and morphoeic subtypes. Mohs micrographic surgery was the most frequently used method of treatment. A history of preceding trauma, surgery or radiotherapy was described in only 18% of the reported cases. Linear BCC is a rare variant of BCC with distinct morphological and histological features, which have led some authors to regard it as a separate condition.

## Introduction

Linear basal cell carcinoma (BCC) was first described as a new clinical subtype in 1985 by Lewis.<sup>1</sup> This report described a linear, pigmented BCC on the cheek of a 73-year-old man. Histologically this was of the nodular subtype of BCC, but because of the distinct linearity of the tumour, it was classified as a separate distinct condition. Since then, only 37 cases worldwide have been reported.<sup>2–11</sup> Having managed two cases recently, we were prompted to review the available literature on linear BCC. In this article, we describe the principal features of the conditions, and discuss possible reasons for its distinctive presentation.

## Methods

We conducted a literature search from 1985 to 2008 for all published articles on linear BCC in PubMed (National Library of Medicine, Bethesda, MD, USA) using the keywords 'linear' and 'basal cell carcinoma'. In total, 15 articles were identified and reviewed, reporting 37 cases of linear BCC in 35 patients (1 patient had 3 linear BCCs). Criteria for inclusion in our review were patients with morphologically linear BCC confirmed by histological examination. Gender, age, location of the tumour, histology and treatment method(s) used were recorded. Follow-up and recurrence rates were not included because of the lack of consistent documentation of such data in the case reports.

## Results

The clinical and histological data for all 37 patients (including our 2 patients; Fig. 1) are outlined in Table 1. There were 19 women and 18 men (mean  $\pm$  SD age 72.2  $\pm$  10.96 years; range 40–87).

*Correspondence:* Dr Firas Al-Niaimi, Department of Dermatology, Salford Royal Hospital, Stott Lane, Manchester M50 3TZ, UK  
E-mail: firas55@hotmail.com

Conflict of interest: none declared.

Accepted for publication 9 April 2010



**Figure 1** Linear scar-like basal cell carcinoma (BCC) on the chest of a 77-year-old man with no previous history of BCCs.

The periocular skin and the neck were the most frequently sites ( $n = 13$  each, 68% in total), and only 1 case in the scrotum was reported. Most tumours were histologically nodular ( $n = 27$ ; 69%). Mohs micrographic surgery (MMS) was the commonest method of definitive treatment used ( $n = 23$  cases; 57%), followed by primary excision with variable margins ( $n = 17$ ; 44%). Trauma, previous operation or radiotherapy in association with the site of the linear BCC was described in only seven cases (18%).

## Discussion

Linear BCC is an uncommon morphological variant first described by Lewis<sup>1</sup> in 1985; since then, 37 cases have been reported. This low incidence of linear BCC in relation to the relatively high incidence of BCCs found worldwide may be partly explained by the lack of objective criteria for defining linear BCCs.<sup>12</sup> This may have led to under-recognition of many cases, which will have been otherwise classified according to the currently well-established subtypes: nodular, superficial, morphoeic or pigmented.

Linear BCC seems to extend preferentially in one direction, resulting in a characteristic morphology of a linear lesion with straight edges and a length much longer than the width (with a ratio of at least 3 : 1<sup>4</sup>), a finding seen in all of the cases described. Of the reported 37 cases, both the periocular area and the neck were the commonest sites involved. The occurrence of the tumour in otherwise unusual sites such as the scrotum may suggest aetiological factors other than ultraviolet radiation. Trauma and koebnerization have both been proposed as possible factors.<sup>10</sup> Although the theory of trauma in the development of linear BCC may be

plausible, a history of trauma was only reported in 3 (8%) of the 37 patients reported. Three lesions of linear BCC in one patient appeared on the neck after radiation for thyroid carcinoma; however, the lesions were not contiguous with the thyroidectomy scars or directly within the radiotherapy fields. This seems to corroborate the conclusions of Peschen *et al.*<sup>10</sup> that it is unlikely that Köebner phenomenon is related to the linear pattern of this morphological variant.

Most of the linear tumours reported were aligned along relaxed skin tension lines. BCCs depend on stromal interactions for progression and growth, and Pierard *et al.*<sup>13</sup> found that in the reticular dermis, skin tension lines have an anatomical counterpart consisting of a preferential parallel orientation and a straightening of thin collagen bundles and elastic fibres. These parallel bundles lie perpendicular to the direction of contraction of the underlying muscles. The linearity of the tumour may therefore be due in part to the stromal interactions with relaxed skin tension lines, coupled with muscle contraction constraining growth in one direction. However, this mechanism cannot fully explain all linear BCCs, such as those appearing on the trunk. This has led to some speculation about orientation along embryonic cleavage planes. Chopra *et al.*<sup>7</sup> suggested that the linearity can be explained by lateral limitations to lesional spread resulting from reactive dermal fibrosis. This may explain the linearity of the tumours appearing on the background of fibrotic dermis after radiation, trauma and possibly previous scarring.

Although most of the reported cases were of the nodular histological subtype (69%), 12 tumours (32%) had infiltrative or morphoeic histology. Despite the relatively small number of reported cases, this percentage is much greater than that expected in the general population. Most of the tumours found on the neck had different histological features from those of the common superficial variant.<sup>14</sup> Based on our findings, the histological subtype of linear BCCs seems to be proportionately more diverse than would be expected.

Furthermore, the clinical appearance in some cases did not correlate with the histological pattern, and it is therefore a poor indicator of the possibility of subclinical extension of the tumour. Lim *et al.*<sup>6</sup> have therefore suggested that MMS should be the treatment of choice. Most the cases reviewed ( $n = 23$ , 57%) were in fact treated by MMS, whereas the others were treated by primary excision with variable margins ranging from 2 to 100 mm. The high percentage of MMS procedures may reflect the local availability and expertise in such procedures, as 17 of the 23 cases were performed at the Mayo clinic.<sup>6</sup> One limitation of this review may

**Table 1** Demographic and treatment details.

References	Gender	Age, years	Anatomical location	Subtype	Treatment
This paper	M	77	Chest	Nodular	Excision
	F	63	Forehead	Nodular	MMS
Pardavila <i>et al.</i> <sup>2</sup>	F	83	Neck	Not mentioned	Excision
	M	69	Lower eyelid	Nodular	Excision
Shinsuke <i>et al.</i> <sup>3</sup>	F	87	Nasolabial fold	Nodular	Excision
Mavrikakis <i>et al.</i> <sup>4</sup>	F	79	Lower eyelid	Nodular	Frozen section
	M	77	Lower eyelid	Nodular	MMS
	M	72	Lower eyelid	Pigmented nodular/infiltrative	MMS
	F	68	Lower eyelid	Pigmented nodular/infiltrative	MMS
Ning and Chao <sup>5</sup>	M	70	Scrotum	Micro-nodular	Excision
Lim <i>et al.</i> <sup>6</sup>	F	62	Cheek	Micro-nodular	MMS
	F	79	Neck	Morpheic	MMS
	M	77	Lower eyelid	Nodular	MMS
	F	79	Cheek	Nodular/infiltrative	MMS
	M	51	Lower eyelid	Nodular	MMS
	F	73	Lower eyelid	Micro-nodular	MMS
	M	74	Neck	Nodular	MMS
	M	84	Lower eyelid	Infiltrative	MMS
	M	86	Lower eyelid	Nodular	MMS
	M	87	Cheek	Metatypical	MMS
	F	85	Neck	Nodular	MMS
	F	87	Upper eyelid	Infiltrative	MMS
	M	80	Lower eyelid/cheek	Nodular	MMS
	F	74	Neck	Nodular	MMS
	F	68	Groin	Metatypical	MMS
	M	73	Medial canthus	Nodular	MMS
	Chopra <i>et al.</i> <sup>7</sup>	M	81	Neck	Micro-nodular
F		63	Neck	Pigmented	Excision
F		63	Neck	Pigmented	Excision
da Silva <i>et al.</i> <sup>8</sup>	F	67	Neck	Pigmented	Excision
Warthan <i>et al.</i> <sup>9</sup>	F	84	Back	Not mentioned	Excision
Peschen <i>et al.</i> <sup>10</sup>	M	40	Shoulder	Not mentioned	MMS
	F	77	Neck	Morpheic	MMS
Lewis <sup>11</sup>	M	52	Neck	Nodular	Excision
	F	62	Shoulder	Nodular	Excision
	M	65	Face	Nodular	Excision
Lewis <sup>1</sup>	F	69	Neck	Nodular	Excision
	M	73	Cheek	Nodular	Excision

MMS, Mohs micrographic surgery.

therefore be a disproportionate reporting of MMS as a treatment choice for linear BCCs. There is no suggestion or evidence in the literature to suggest that this subtype of tumour is congenital.

In conclusion, linear BCC is a distinct clinical morphological variant of BCC, with the potential for wider subclinical extension and a relatively varied histology with a high incidence of infiltrative and morpheic subtypes.<sup>4,6</sup> It is therefore best regarded as a high-risk subtype.<sup>4</sup> From our findings, we believe that this subtype of BCC is genuinely rare, but may be under-reported due to under-recognition of it as a distinct

presentation of BCC. To date, no cases of metastatic spread have been reported. The possibility of a linear BCC should be considered in the presence of a spontaneous linear scar, particularly in the periocular or neck area.

The presence of the tumour along relaxing tension lines, the disproportionately high percentages of infiltrative and morpheic subtypes, and an increase in subclinical extension are reported observations that have led some authors to suggest that MMS should be considered as the first-line treatment in linear BCCs.<sup>4,6</sup>

## References

- 1 Lewis JE. Linear basal cell epithelioma. *Int J Dermatol* 1985; **24**: 124–5.
- 2 Pardavila R, Roson E, de la Torre C *et al*. Linear basal cell carcinoma. Report of two cases. *Actas Dermosifiliogr* 2007; **98**: 291–5.
- 3 Shinsuke K, Hirohiko K, Yasuhiro T *et al*. Linear basal cell carcinoma in an Asian patient. *Open Ophthalmol J* 2007; **1**: 20–2.
- 4 Mavirakis I, Malhotra R, Selva D *et al*. Linear basal cell carcinoma: a distinct clinical entity. *J Plast Reconstr Aesthet Surg* 2006; **59**: 419–23.
- 5 Ning C, Chao S. Linear basal cell carcinoma of the scrotum. *Dermatol Sinica* 2002; **20**: 57–62.
- 6 Lim KK, Randle HW, Roenigk RK *et al*. Linear basal cell carcinoma: report of seventeen cases and review of the presentation and treatment. *Dermatol Surg* 1999; **25**: 63–7.
- 7 Chopra KF, Cohen PR. Linear basal cell carcinomas: report of multiple sequential tumors localized to a radiotherapy port and review of the literature. *Tex Med* 1997; **93**: 57–9.
- 8 da Silva MO, Dadalt P, Santos OL *et al*. Linear basal cell carcinoma. *Int J Dermatol* 1995; **34**: 488.
- 9 Warthan TL, Lewis JE. Giant linear basal cell epithelioma. *Int J Dermatol* 1994; **33**: 284.
- 10 Peschen M, Lo JS, Snow SN, Mohs FE. Linear basal cell carcinoma. *Cutis* 1993; **51**: 287–9.
- 11 Lewis JE. Linear basal cell epithelioma. *Int J Dermatol* 1989; **28**: 682–4.
- 12 Connelly T. Linear basal cell carcinomas. *Dermatol Surg* 1999; **25**: 422.
- 13 Pierard GE, Lapiere CM. Microanatomy of the dermis in relation to relaxed skin tension lines and Langer's lines. *Am J Dermatopathol* 1987; **9**: 219–24.
- 14 Goldberg LH, Leis P, Pham HN. Basal cell carcinoma on the neck. *Dermatol Surg* 1996; **22**: 349–53.