

A SURVEY OF NEOPLASIA IN DOMESTIC SPECIES OVER A 40-YEAR PERIOD FROM 1935 TO 1974 IN THE REPUBLIC OF SOUTH AFRICA. III. TUMOURS OCCURRING IN PIGS AND GOATS

STELLA S. BASTIANELLO, Section of Pathology, Veterinary Research Institute, Onderstepoort 0110

ABSTRACT

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A survey was carried out on all the neoplasms in pigs and goats which are recorded in the registration files of the Section of Pathology of the Veterinary Research Institute at Onderstepoort over a period of 40 years, from 1935 to 1974. The tumours encountered in these 2 species were tabulated separately according to their type and site of origin.

In pigs, 24 tumours were recorded, and in goats, only 21. Of the porcine neoplasms 13 (54%) were lymphosarcomas, 5 (20,8%) were cutaneous squamous cell carcinomas and 2 (8,4%) were embryonal nephromas.

In goats, 8 (38%) of the tumours were squamous cell carcinomas, 50% of which occurred in the perineal region. Malignant melanomas and papillomas each made up 19% of the total, whilst lymphosarcomas accounted for 14% of the total caprine tumours.

INTRODUCTION

Amongst the domestic animals, the occurrence of tumours in pigs is usually low. Sastry & Tweihaus (1965) and Monlux, Anderson & Davis (1956) in the United States of America (USA), and Plummer (1956) in Canada recorded, respectively, incidences of only 5,3% (37 out of 709), 3,2% (32 out of 1006) and 4,4% (28 out of 636) for porcine tumours as a proportion of the total tumours encountered in domestic animal species. In the Republic of South Africa (RSA), Jackson (1936) recorded only 4 tumours in pigs out of a total of 316 tumours amongst cattle, sheep, goats, horses and pigs. In a survey conducted in Israel the incidence was also low, only 2 out of a total of 709 tumours in domestic animals being recorded (Nobel, Klopfer, Perl & Nyska, 1979). In Holland, a slightly higher incidence (10% out of 333) of porcine tumours than in the countries mentioned above was recorded (Misdorp, 1967).

Lymphosarcomas were the most common tumour encountered in pigs in Holland (Misdorp, 1967), the USA (Sastry & Tweihaus, 1965), Canada (Plummer, 1956), and the United Kingdom (Cotchin, 1960), and were the only type recorded amongst pigs in Israel (Nobel *et al.*, 1979). Embryonal nephromas are also regarded as a common porcine tumour and in one survey in the USA they were the most common type of tumour recorded (Monlux *et al.*, 1956), whilst in other surveys they were the second most frequent type (Plummer, 1956; Sastry & Tweihaus, 1965; Misdorp, 1967). In the RSA, however, Jackson (1936) did not encounter any lymphosarcomas or embryonal nephromas in a series of 4 porcine neoplasms. Schulz & Schutte (1960) reported on the occurrence of multiple acanthomas in the skin of swine in the RSA.

The numbers of caprine tumours recorded in surveys conducted in various countries have also been low. In the United Kingdom, Cotchin (1960) recorded only 4 caprine tumours out of a total of 452, 3 of which were lymphosarcomas. In India, melanomas and squamous cell carcinomas of the skin and papillomas of the skin or lips were the most common caprine neoplasms (Damodaran & Parthasarathy, 1972). Zubaidy (1976), in Iraq, in a series of 4 neoplasms, noted squamous cell carcinomas of the skin to be the most frequent type. Jackson (1936), in the RSA, recorded a relatively high number of caprine tumours, namely, 46 out of 316 tumours in cattle, sheep, horses, pigs and goats. Of these 46 tumours, 20 were melanomas and 20 squamous cell carcinomas.

MATERIALS AND METHODS

The material for this survey was obtained from formalin-fixed tissues submitted to the Section of Pathology of the Veterinary Research Institute (VRI) at Onderstepoort by private or state veterinarians or stock inspectors from all parts of the RSA.

The registration files for each year of the survey were carefully screened and all cases diagnosed as neoplasms were noted. The pertinent data on these cases were recorded in separate registration files. The written reports for each individual tumour were also examined and any other significant data were noted and added to those obtained from the registration files. The tumours encountered in the 2 species were totalled and tabulated in separate tables according to their types and sites of origin. In the case of the goat, a series of tumours were re-cut and re-examined under the light microscope, so that any tumours which were referred to in the past by terms no longer in use could be reclassified, using current terminology. All the tumours in both the pig and the goat have been tabulated in this way.

RESULTS

The 24 porcine and 21 caprine tumours recorded are tabulated in Tables 1 & 2 respectively. Features of a malignant melanoma on the ear of a goat are depicted in Fig. 1-4.

TABLE 1 Tumours recorded in pigs from 1935 to 1974

Type	Site	Number	% of 24 tumours
Lymphosarcoma	Lymph node	8	54%
	Lymph node and other organs	3	
	Kidney	1	
	Ovary	1	
Leukaemia		1	4,2%
Squamous cell carcinoma	Skin	5	20,8%
Embryonal nephroma		Kidney	
Hepatocellular carcinoma	Liver	1	4,2%
Bile duct adenoma	Liver	1	4,2%
Granulosa cell tumour	Ovary	1	4,2%
Total		24	100%

Pigs

Out of the 24 tumours recorded in pigs, 13 (54%) were lymphosarcomas the site and origin of which could not be ascertained (Table 1). Eight involved various lymph

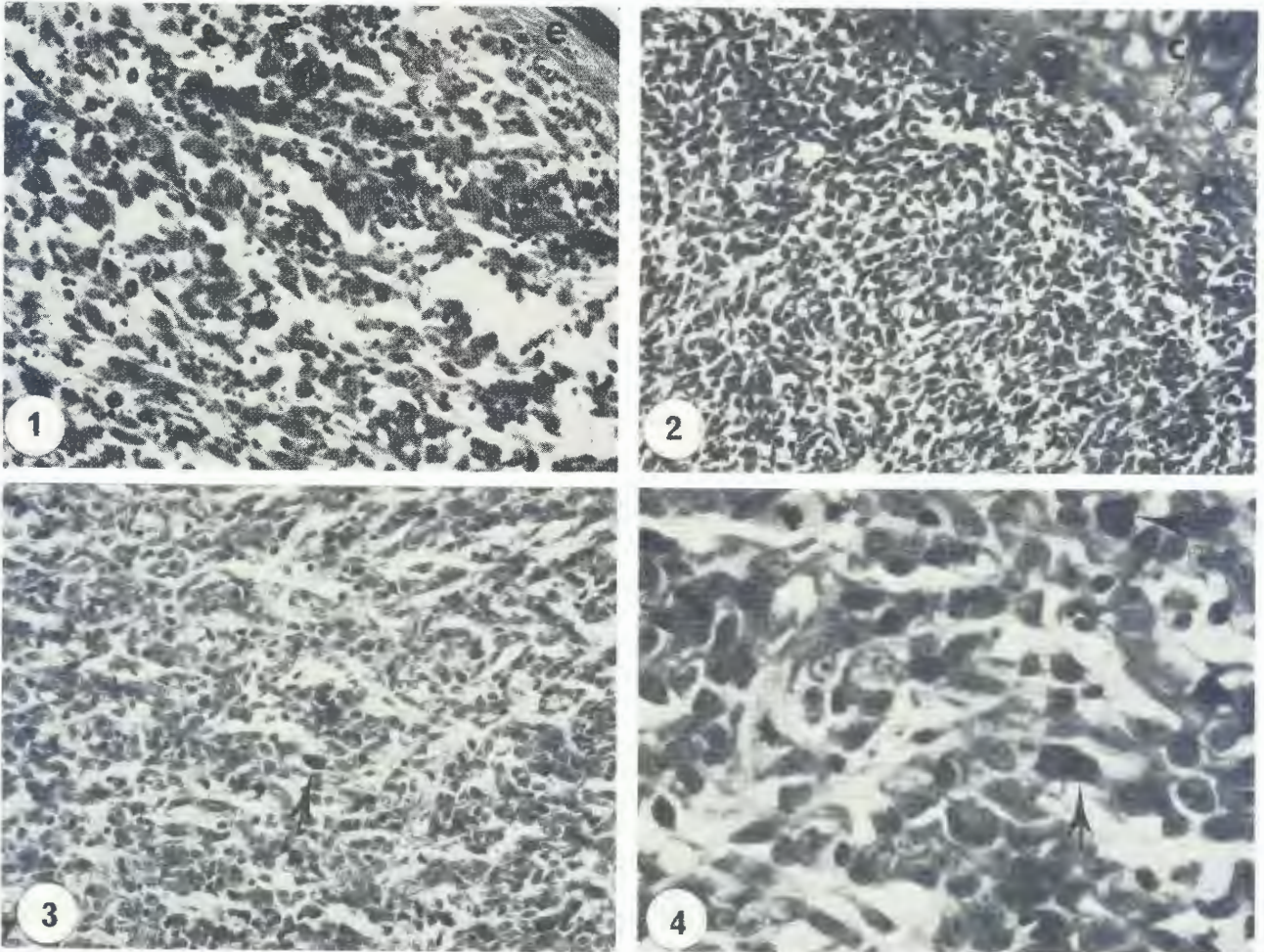


FIG. 1 Malignant melanoma. Spindle-shaped or plump, round tumour cells extending right up to overlying necrotic epithelium (e) of the ear of a goat: HE × 200
 FIG. 2 Spindle-shaped tumour cells of malignant melanoma extending right down to cartilage (c) of ear: HE × 200
 FIG. 3 Malignant melanoma. Plump, spindle-shaped and dark-staining tumour cells containing pigment (arrow) in central region of tumour: HE × 200
 FIG. 4 Note mitotic figures and melanin pigment granules in dark-staining cells in a malignant melanoma (arrows): HE × 500

nodes, although the specific lymph nodes affected could not be determined from the available data. Three cases had a generalized distribution involving lymph nodes and other tissues, especially the liver and kidney. One lymphosarcoma reportedly arose in the kidney and another in the ovary.

Squamous cell carcinomas accounted for 5 (20,8%) of the total tumours. Embryonal nephromas were the 3rd most frequently encountered type of tumour, although they accounted for only 2 (8,4%) of the 24 tumours. Two tumours, occurring in the ovary, included 1 lymphosarcoma and 1 granulosa cell tumour. There were 2 tumours arising in the liver, a hepatocellular carcinoma and a bile duct adenoma. One case of leukaemia was recorded, but the type could not be determined from the registration files.

Goats

Twenty-one tumours were recorded in goats (Table 2). Out of these, 8 (38%) were squamous cell carcinomas of the skin, 4 (19%) were malignant melanomas, and 4 papillomas. Four (50%) of the cutaneous squamous cell carcinomas occurred in the perineal region. Malignant melanomas were encountered at various sites, including the perineal region, vulva and ear. The histopathological features of a malignant melanoma on the ear of a goat are depicted in Fig. 1-4. Three out of the 4 papillomas were

of cutaneous origin, whilst one arose in the oral cavity. Two of the cutaneous papillomas originated on the ear. Lymphosarcomas were the 3rd most commonly encountered tumours, accounting for 3 (14%) out of the 21 tumours. One mesothelioma and 1 haemangiosarcoma were also recorded.

TABLE 2 Tumours in goats from 1935 to 1974

Type	Site	Number	% of 21 tumours
Squamous cell carcinoma	Skin—udder	1	38%
	Skin—unspecified	3	
	Skin—perineum	4	
Malignant melanoma	Skin—perineum	1	19%
	Skin—unspecified	1	
	Vulva	1	
	Ear	1	
Papilloma	Skin—ear	1	19%
	Skin—unspecified	2	
	Oral cavity	1	
Lymphosarcoma	Lymph node—unspecified	3	14%
Haemangiosarcoma	Skin	1	5%
Mesothelioma	Peritoneum	1	5%
Total		21	100%

DISCUSSION

The commonest type of neoplasm encountered in the pig was the lymphosarcoma, which accounted for 13 (54%) out of the 24 tumours. Similar incidences have been recorded in other countries, among them Canada, England, and the USA (Plummer, 1956; Cotchin, 1960; Sastry & Tweihaus, 1965). Misdorp (1967) in Holland reported a somewhat lower incidence of 37.5% for lymphosarcomas. In all these surveys the lymphosarcoma was also the most frequent type of porcine neoplasm encountered. No lymphosarcomas were recorded in pigs in a previous survey (1920–1935) of tumours in domestic animals in the RSA (Jackson, 1936).

The exact site and distribution of the 13 porcine lymphosarcomas could not be determined. Eight involved various lymph nodes, whilst in 3 cases the lymph nodes and other tissues, especially the liver and kidneys, were affected. Lymphosarcomas in pigs reportedly involve either the lymph nodes on their own or the lymph nodes and other organs, especially the liver, kidneys and spleen (Plummer, 1956; Cotchin, 1960; Misdorp, 1967). According to Monlux *et al.* (1956), the sublumbar, renal and iliac lymph nodes were the sites most frequently affected. They also reported a case of cervical vertebral involvement. Cotchin (1960) noted that the anterior mediastinal lymph nodes were frequently affected, whilst in a series of 92 cases of lymphosarcoma McTaggart, Head & Laing (1971) reported 57 to be multicentric and 35 thymic in origin.

The age of the pigs with lymphosarcoma in this survey could not be ascertained. However, during the course of routine histopathological examinations, lymphosarcomas have been noted mostly in younger pigs of porker (4–5 months) or baconer age (7–8 months) and only rarely in older pigs (S. Bastianello, 1977–1981, unpublished observations). Monlux *et al.* (1956) recorded that 8 out of 9 lymphosarcomas occurred in piglets between 6–12 months of age and only 1 in an older sow, whilst Cotchin (1960) reported that pigs were affected from new-born to 16 months. Bostock & Owen (1973), when reviewing ovine and porcine lymphosarcomas, noted that lymphosarcomas usually occurred in pigs under 8 months of age, although in one series cited 20% involved slightly older pigs of about 21 months of age.

Five (20.8%) out of the 24 porcine tumours were squamous cell carcinomas of the skin. These tumours represent the cases described by Schulz & Schutte (1960) who reported the incidence of multiple acanthomas (squamous cell carcinomas) of the skin in pigs of the Large White breed from 3 separate sources in the RSA. These tumours occurred only in breeding sows as nodules over practically the entire body surface except the limbs. Microscopically, these nodules were diagnosed as typical squamous cell carcinomas. The workers were not able to determine the cause of this condition, and the disease has not recurred since the original report in 1960. In the literature reviewed only 1 other cutaneous squamous cell carcinoma in a series of 28 porcine neoplasms could be found (Plummer, 1956).

The 3rd most frequently encountered porcine tumour was the embryonal nephroma, although it accounted for only 2 (8.4%) out of the 24 tumours. In Colorado in the USA and in Canada, embryonal nephromas were the commonest type of tumour recorded (Monlux *et al.*, 1956; Plummer, 1956), while in England they were the 2nd most frequent after lymphosarcomas (Cotchin, 1960). Misdorp (1967), in Holland, reported an equal incidence for lymphosarcomas and embryonal nephromas. The surveys conducted in these countries were based on tissues collected at abattoirs. Migaki, Nelson & Todd (1971) stated that embryonal nephromas are the

most commonly encountered neoplasm in slaughtered swine, whilst Sullivan & Anderson (1959) found it to be 2nd in incidence after lymphosarcomas. The low incidence of embryonal nephromas in the present survey may be because material was obtained from both abattoir and other sources. Sastry & Tweihaus (1965) found a similar low incidence (2 out of 35) for this tumour. Their material also originated from abattoir and other sources.

In goats, only 21 tumours were recorded. A similar low incidence has been reported in other countries, including the United Kingdom, India, Iraq and Israel (Cotchin, 1960; Damodaran & Parthasarathy, 1972; Zubaidy, 1976; Nobel *et al.*, 1979). Al Saleem (1974), cited by Zubaidy (1976), suggested that this low incidence probably occurs because goats are slaughtered early in life before cancer age is attained. This low world-wide occurrence could also be due to the smaller number of goats compared to that of other large domestic species such as cattle, sheep, horses and pigs. Jackson (1936), in the RSA, reported a surprisingly high number of 46 tumours in goats over a 15-year period from 1920–1935. This high incidence was probably attributable to the submission of an increased number of caprine tumours to the VRI for histopathological diagnosis during this period when a country-wide survey to investigate skin cancer in the Angora goat in the RSA was carried out (Thomas, 1929).

The most frequent caprine tumour in this survey was the cutaneous squamous cell carcinoma, which accounted for 8 (38.1%) of the total. Jackson (1936), recorded 20 (43.5%) out of 46 tumours as cutaneous squamous cell carcinomas, whilst Zubaidy (1976), in Iraq, recorded 3 out of 4 tumours to be of this type. In contrast to these findings, only 2 (18%) out of a series of 11 tumours in goats in India were squamous cell carcinomas (Damodaran & Parthasarathy, 1972), while none were recorded amongst 6 tumours from goats in Israel (Nobel *et al.*, 1979). Four out of the 8 squamous cell carcinomas in this series occurred in the perineal region. Jackson (1936) and Zubaidy (1976) also reported the perineal region to be the most frequent site for cutaneous squamous cell carcinomas in the goat. The high sunlight intensity in the RSA may account for this high incidence of squamous cell carcinomas in goats. In sheep, squamous cell carcinomas, after jaagsiekte, were the type of tumour most frequently encountered in the RSA (Bastianello, 1982).

The second most frequently encountered caprine tumour was the malignant melanoma, which accounted for 19% of the total. Jackson (1936) recorded a considerably higher incidence (43.5%) for this neoplasm. The latter probably arose because of the inclusion of several tumours originating from the Angora goat. Thomas (1929) noted that malignant melanomas, especially of the perineum, vulva and anus, were by far the commonest tumour of the Angora goat. The number of malignant melanomas recorded in this survey was too low to arrive at any significant conclusions as to their site of origin.

However, 3 occurred, 1 in the perineal region, 1 in the vulva and 1 on the ear. Jackson (1936) noted that the perineum and ear were the most frequent sites for the development of this tumour. Damodaran & Parthasarathy (1972), in India, recorded 3 (27.2%) melanomas out of a total of 11 tumours, although in this case the perineum and ear were not involved.

Cutaneous papillomas accounted for 19% of the total caprine tumours. In contrast to this finding, Jackson (1936) reported only 1 papilloma out of 46 neoplasms. In India, papillomas together with melanomas were the tumours most commonly encountered in goats (Damodaran & Parthasarathy, 1972), whilst, in Israel, 5 out of 6

tumours were papillomas (Nobel *et al.*, 1979). Three out of the 4 papillomas in this series were cutaneous in origin, although the exact site could only be determined in 1 case. Smit (1962) identified the udder as a common site for cutaneous papillomas in goats. Davis & Kemper (1936), reporting on papillomatosis in Saanen milking goats, stated that no papillomas were observed on the teats or udder. Instead, they reported that the commonest sites were the neck, head, shoulders and fore-limbs above the knees.

The only other significant neoplasm recorded in goats was the lymphosarcoma, which was the 3rd most frequent type of tumour and accounted for 14% of the 21 tumours. Amongst 6 tumours recorded in goats in Israel, 1 was a lymphosarcoma (Nobel *et al.*, 1979) while Cotchin (1960), in the United Kingdom, reported 3 out of 4 caprine neoplasms to be lymphosarcomas.

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