

Bovine Neoplasms Encountered in Canadian Slaughterhouses: A Summary

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SUMMARY

During the past five and one half years veterinarians of the Food Production and Inspection Branch of Agriculture Canada submitted tissues from 1535 cases of suspected bovine neoplasia for diagnosis to the Animal Diseases Research Institute, Nepean. Neoplasia was confirmed in 1370 cases. Lymphosarcoma was diagnosed in 738 (53.9%) of these cases, but it was not possible to accurately assess the prevalence of this condition at slaughter. Other commonly found neoplasms in order of frequency were neurofibroma, squamous cell carcinoma, uterine carcinoma, adrenal tumors, ovarian tumors and primary liver tumors. Many metastatic anaplastic carcinomas involving lymph nodes were not specifically identified as to tissue of origin. Nonneoplastic lesions were found in 165 submissions.

RÉSUMÉ

Néoplasmes bovins observés dans des abattoirs canadiens

Au cours des derniers cinq ans et demi, les vétérinaires de la Direction générale de la production et de l'inspection des aliments d'Agriculture Canada ont expédié à l'Institut de recherches vétérinaires de Nepean, 1535 échantillons bovins dans lesquels ils soupçonnaient la présence de lésions néoplasiques. Le laboratoire confirma leurs soupçons, dans 1370 des cas. On diagnostiqua la présence de lymphosarcome dans 738, i.e. 53,9% de ces échantillons; il s'avéra toutefois impossible d'évaluer de façon précise la fréquence de cette tumeur, lors de l'abattage. L'ordre d'importance des autres néoplasmes fréquents se présenta de la façon suivante : neurofibrome, épithélioma spinocellulaire, épithélioma utérin,

tumeurs surrénaliennes, tumeurs ovariennes et tumeurs primaires du foie. Il s'avéra impossible de préciser l'origine de plusieurs métastases anaplasiques, retrouvées dans des ganglions lymphatiques. Dans 165 échantillons, les lésions se révélèrent de nature non néoplasique.

INTRODUCTION

This study was originally undertaken to provide data concerning the prevalence of bovine lymphosarcoma in the Canadian cattle population for the use of those concerned with establishing control or eradication programs for enzootic bovine leucosis. It was also hoped that this information would provide general knowledge on bovine neoplasia in Canada. Surveys of this type have been carried out in other countries (1-6). Plummer (8-10) published surveys of slaughterhouse tumors in Canada over twenty years ago.

The purpose of this communication is to tabulate and report the findings of a histopathological study of bovine neoplasia submitted to this laboratory by meat inspectors of Agriculture Canada (Food Production and Inspection Branch) during five and one half years. Enzootic bovine leucosis has become a more important bovine disease as a result of serious consequences for international trade. Some countries restrict the importation of animals from herds which contain positive animals, and others restrict the importation of positive animals. Even the importation of semen from bulls located in studs or herds which contain positive animals is restricted in some cases.

MATERIALS AND METHODS

Inspectors of Agriculture Canada were requested to submit fixed tissue

specimens from all cases of suspected bovine neoplasia encountered during the course of routine meat inspection. Paraffin sections were prepared and routinely stained with hematoxylin and eosin. The tumors were grouped by body systems based on the histopathological diagnosis.

RESULTS

During this study 1535 submissions of suspected bovine neoplasia were received (Tables I and II). Neoplasia was confirmed in 1370 cases. The remaining 165 were primarily a mixture of inflammatory conditions. Nearly 17 million cattle were slaughtered during this time in federally registered plants but accurate calculation of the prevalence of neoplasia was not possible.

Neoplasms were grouped by body system of origin (Table I). In many carcinomas, the tissue of origin was not definitely established because of the anaplastic and scirrhous nature of the mass. They were metastatic to the tissues submitted, and the primary site was not submitted or indicated in the history accompanying the submission. Metastatic lesions of uterine carcinoma accounted for the majority of neoplasms found in the lung. Lymphosarcomas, neurofibromas, squamous cell carcinomas, uterine carcinomas, adrenal, ovarian, and liver tumors were commonly encountered.

Sarcomatous neoplasms (excluding lymphosarcoma) were less frequently found. Most of these were fibromas or fibrosarcomas. Tumors placed in this group were from muscle, other connective tissues (bone, fat, mesodermal tissue) and vascular tissue (Table I). One myeloma and 738 (53.9%) lymphosarcomas were found (Table I). These were found in all age groups and both

sexes of cattle from most provinces. There were 412 submitted from Ontario, 210 from Quebec, 63 from Manitoba and 28 from Alberta. Only 14 were from Saskatchewan, six from New Brunswick and two or less in each of the other provinces. Animals were from three weeks to 15 years with peaks of incidence at one to two years and six to seven years. Affected males were younger animals. Melanoma and melanosis were easily recognized by the inspectors although there was some confusion between the two. Understandable confusion also existed between the diagnosis of mesothelioma and peritonitis. Neurofibromas in the heart were often confused with cysticercosis.

Enlargement of lymph nodes (66/165) accounted for the majority of the nonneoplastic cases. Hyperplasia of lymph nodes and lymphadenitis were found 33 times each. In the latter group fungal elements were demonstrated in four, mycobacteria in five, and antinobacilli in 15. Pale areas in various tissues, observed during gross

examination, were sometimes interpreted as lymphosarcoma but 20 such submissions were classed as degenerative change and 26 as chronic nephritis (Table II).

DISCUSSION

This survey of tumors in slaughter cattle represents submissions from across Canada. There may be some regional variation in slaughter pattern because older cattle tend to be slaughtered in specific plants. This may account for some of the variation between provinces. Ninety-five percent of all red meat in Canada is slaughtered in the approximately 100 federally inspected establishments but unfortunately not all neoplasms were submitted for laboratory confirmation. When comparing accession numbers with condemnations figures we found we had only received specimens from slightly more than half of the neoplasms in federally inspected plants although for several plants in Ontario, killing older animals, we received virtually all of them. This approximately 50% sub-

TABLE II
SUBMISSIONS NOT CONFIRMED AS NEOPLASIA

Diagnosis	No.
Abscess	5
Chronic pneumonia	4
Cystitis	1
Degeneration ^a	
- fat	8
- liver	8
- lung	2
- muscle	2
Edema/emphysema	
- lymph node	3
- lung	2
Granuloma	
- granulation tissue	13
Hematoma	2
Hyperplasia	
- lymph node	33
- pancreas	2
- spleen	1
- thyroid	1
Keratitis	1
Lymphadenitis	
- actinobacillary	15
- mycobacterial	5
- mycotic	4
- nonspecific	9
Melanosis	3
Myocarditis	2
Nephritis	26
Normal tissue	2
Peritonitis	7
Sarcosporidiosis	1
Spondylosis	3
Total	165

^aIncludes necrosis and fibrosis.

TABLE I
BOVINE NEOPLASMS 1974-1980 COMPARED WITH THAT OF PLUMMER 1956

System	Diagnosis	Current Study	Plummer Study
Alimentary and Peritoneum	Mesothelioma	19	29
	Carcinoma — intestine	1	1
	Fibropapilloma (polyp)	4	0
Bones, Joints, Connective Tissue	Fibroma (sarcoma)	16	19
	Osteo-chondroma (sarcoma)	2	6
	Lipoma	2	1
	Myxoma	4	0
	Leiomyoma	3	0
Endocrine	Rhabdomyosarcoma	2	0
	Adrenal -cortex	23	9
	-medulla	28	2
	Thyroid	1	0
Female Genital	Uterus -Carcinoma ^a	53	0
	Ovary -Carcinoma	9	0
	-Granulosa cell	29	11
Hemopoietic and Circulatory	Lymphosarcoma	738	159
	Myeloma	1	0
	Hemangiosarcoma	4	7
Liver	Carcinoma or adenoma bile duct	27	17
	Carcinoma or adenoma hepatocyte	8	4
Nervous	Neurofibroma ^a	123	5
Respiratory	Lung-carcinoma ^a	4	36
Skin	Squamous cell carcinoma	101	107
	Melanoma (sarcoma)	7	5
Unknown	Carcinoma -metastatic/schirrous	153	21
	Sarcoma	5	0
Urinary	Embryonal nephroma	2	4
	Carcinoma	1	1
Other ^b		0	3
Total		1370	447

^aObvious differences in the numbers between this survey and that of Plummer (10).

^bPlummer also found one each of astrocytoma, teratoma and mixed tumour.

mission rate for areas outside Ontario was calculated after excluding condemnations for ocular squamous neoplasia from Alberta and Saskatchewan. These are easily recognized on gross examination and tend not to be submitted although considered part of this study. Other submissions were sent to pathology laboratories closer to the plants. The submissions of all neoplasms decreased in number during the last year and a half of the study. As a result we were unable to accurately define the prevalence of various types of neoplasia in cattle and more especially the prevalence of lymphosarcoma at slaughter in federal plants which was the original intent of this study. A very rough estimate of all neoplasia in Canadian cattle might be obtained by assuming that the data in Table I represents 50% of the total number of neoplasms for 17 million animals slaughtered. To do the same for each type of neoplasm would not yield reliable information.

This survey found as did Monlux *et al* (6) that many bacterial and parasitic granulomas and a variety of other lesions were submitted because neoplastic conditions were suspected on

gross examination of the carcasses. This accounts for some enlarged lymph nodes being diagnosed as lymphadenitis and pale areas in kidneys being diagnosed as chronic nephritis rather than lymphosarcoma as was suspected. The gross differentiation of degenerate tapeworm cysts from neurofibroma was found in this study by Monlux *et al* (6) to be a problem for meat inspectors. Histological confirmation of suspected neoplasms is essential.

The findings of this study are similar to those reported previously in Canada by Plummer (8,9,10). Lymphosarcoma was the most common neoplasm. There were some obvious differences however, to Plummer's survey (10) (Table I). More neurofibromas were found in this survey which may be the result of recent emphasis on cysticercosis at the slaughterhouse. Few primary lung tumors were found in this survey whereas Plummer reports a moderate number. Most lung tumors were metastases of primary uterine carcinoma. This difference may be understandable in light of the confusion in distinguishing between the primary and second-

ary lung tumors in past years as discussed by Monlux *et al* (7).

The findings of this survey agree with other surveys (1,2,6) that lymphosarcoma, neurofibroma, squamous cell carcinomas primarily of the eye, uterine carcinomas, adrenal, ovarian and liver tumors are the most common neoplasms of cattle. The entire picture of neoplasia in cattle may never be fully appreciated or understood by a study limited to slaughtered animals, but probably few important types of neoplasia would escape detection unless they cause death.

ACKNOWLEDGMENTS

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REFERENCES

1. ANDERSON, L.J., A.T. SANDISON and W.F.H. JARRETT. A British abattoir survey of tumors in cattle, sheep, and pigs. *Vet. Rec.* 84: 547-551. 1969.
2. BRANDLEY, P. and G. MIGAKI. Types of tumors found by federal meat inspectors in an eight year survey. *Ann. N.Y. Acad. Sci.* 108: 872-879. 1963.
3. DAVIS, C.L., R.B. LEEPER and J.E. SHELTON. Neoplasms encountered in federally inspected establishments in Denver, Colorado. *J. Am. vet. med. Ass.* 83: 229-237. 1933.
4. JACKSON, C. The incidence and pathology of tumours in domesticated animals in South Africa: A study of the Onderstepoort collection of neoplasms with special reference to their histopathology. *Onderstepoort J. vet. Sci.* 6: 1460. 1936.
5. MISDORP, W. Tumours in large domestic animals in the Netherlands. *J. comp. Path.* 77: 211-216. 1967.
6. MONLUX, A.W., W.A. ANDERSON and C.L. DAVIS. A survey of tumors occurring in cattle, sheep and swine. *Am. J. vet. Res.* 17: 646-677. 1956.
7. MONLUX, A.W., W.A. ANDERSON, C.L. DAVIS and W.S. MONLUX. Adenocarcinoma of the uterus of the cow — Differentiation of its pulmonary metastases from primary lung tumors. *Am. J. vet. Res.* 17: 45-73. 1956.
8. PLUMMER, P.J.G. A survey of twenty-four tumours collected from animals slaughtered for food. *Can. J. comp. Med.* 12: 180-186. 1948.
9. PLUMMER, P.J.G. A survey of sixty tumours from domesticated animals. *Can. J. comp. Med.* 15: 231-252. 1951.
10. PLUMMER, P.J.G. A survey of six hundred and thirty-six tumours from domesticated animals. *Can. J. comp. Med.* 20: 239-251. 1956.

ABSTRACTS

UK, Central Veterinary Laboratory. Mastitis surveillance scheme — January to June 1980. *Veterinary Record* (1980) 107: 297-298. (W.A. Edwards, Epidemiology Unit, Central Vet. Lab., Weybridge KT15 3BN, UK).

A total of 8441 milk samples was submitted to V.I. centres in England and Wales from clinical cases of mastitis from a population of 45 000 cows (378 herds) over 6 months; 72% of the cases occurred in the first 3 months (January-March). The distribution of cases with respect to month was as follows: January, 2237; February, 1968; March, 1874; April, 1044; May, 677; June, 641. *Escherichia coli* was the most frequent pathogen isolated from January to May, but *Streptococcus pyogenes* was predominant in June. Over 6 months, *E. coli* was isolated from about 20% of cases in each month and *Str. uberis* from about 12%, though *E. coli* was found less

frequently in May and June (in contrast to *Str. uberis*). The monthly rate of isolation of *Str. dysgalactiae* was constant from January to May. *Str. agalactiae* was isolated from 2% during January to May and 3% in June, being isolated from at least one case in 54 herds (14.3%). *Corynebacterium pyogenes* and pseudomonads gave respective isolation rates of 1% and 1.5%. The mean herd frequency of mastitis was 20.9 cases per 100 cows over 6 months. The herd mean of the percentage of cows affected at least once was 14.3% and percentage of quarters affected at least once was 4.5%. Of the 8441 cases of mastitis, 641 (7.5%) were very severe, 2518 severe and 5282 mild; 14.7% of all cases attributed to *E. coli* were very severe, compared to only 3.3% for *Staphylococcus pyogenes*, 6.7% for *Str. agalactiae*, 6% for *Str. dysgalactiae* and 7.2% for *Str. uberis*.

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Ochoa, R. and Kern, S.R. The effects of *Clostridium perfringens* type A enterotoxin in Shetland ponies — clinical, morphologic and clinicopathologic changes. *Veterinary Pathology* (1980) 17: 738-747. (Dep. Vet. Path., Sch. Vet. Med., State Univ., Baton Rouge, Louisiana, USA).

Severe abdominal pain, signs of colic and haemorrhagic gastroentero-caeco-colitis were induced in three Shetland ponies by i/v injection with *C. perfringens* type A enterotoxin. Histological lesions were congestion, oedema and haemorrhage of the large and small intestine, sloughing of the tips of the intestinal villi, and vacuolar degeneration of hepatocytes with dilation of the spaces of Disse. Clinical changes were severe hypoglycaemia, increased aspartate aminotransferase activity and leukopenia.

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