RABBIT MORTALITY SURVEY.
NECROPSY FINDINGS IN THE FIELD DURING THE PERIOD 1989-1995

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Abstract - The author describes the *post-mortem* findings in 2,140 necropsies carried out during 910 visits at 321 commercial rabbitries, distributed in to 41 provinces of Spain. The period of the study was comprised between January, '89 to December, '95. The objective of this paper is to describe several groups of diseases, only from the observation of gross lesions. 153 females out of 509 studied, developed a respiratory disease (30%) as a probable cause of death. 140, have had a reproductive disease (27.5%), these including: 43 cases of metritis, pyometra and foetal mummification, 39 cases of mastitis, 30 cases of pregnancy toxaemia and 24 cases of uterine torsion. 87 out of 509 does, have had an enteropathy (17%); 73 a viral haemorrhagic disease (VHD) (14.3%), and 56 had miscellaneous or unknown diseases (11%). 219 out of 287 suckling rabbits, developed a digestive disorder (77.6%), 23 a respiratory problem (8%), and 45 died with miscellaneous or unknown processes (15.6%). 561 out of 969 weaned rabbits, were found dead, apparently because of an intestinal disease (57.9%), 300 with respiratory lesions (30.9%), 72 with VHD (7.4%), and 83 were affected by other conditions or were not diagnosed. A total of 1,827 necropsies were made in rabbits that were found dead. Moreover, the author sacrificed 313 young friers; 266 of them, have had gross lesions compatible with encephalitozoonosis.

INTRODUCTION

It is currently accepted that the digestive pathology is the one that prevails in the rabbit production (GALLAZZI *et al.*, 1980, MORISSE *et al.*, 1984; PEETERS, 1988). These diseases are the most important ones in young rabbits, while in adult animals respiratory and reproductive processes are more frequent (NOUAILLE, 1994 ; ROSELL, 1995).

There are papers describing necropsy results of rabbits from commercial units, but made in the laboratory (MAIRE, 1989; CUERVO and MARCO, 1995). Other authors show the results of a small number of farms (OSTLER, 1961, VÔRÔS, 1980), or the results of rabbit necropsies from laboratory stables or experimental units (HINTON, 1979; COUDERT, 1981), or from animals of both origins simultaneously (WHITNEY *et al.*, 1976).

In Spain, a veterinary specialist in rabbits is a generalist, since he studies all the production factors affecting the farms. Due to the economical purpose of rabbitries, the medical perspective must, consequently, run parallel to the economical perspective; a medicine of the production is applied. In diagnostic procedures in the field, necropsies are a useful element, as they are too in a laboratory stable, as suggested by BIVIN and TIMMONS, 1974. Furthermore, in a farm it is essential to converse with the owner, observe the results of the Technical and Economical Management (GTE) and examine the animals.

The objective of this work is to describe the most frequent causes of mortality by the necropsy findings on commercial rabbitries, during a period of seven years. With this publication, the author wants to correspond to the effort carried out by various experts, which received the cases described in their laboratories; their teachings were very useful.

MATERIAL AND METHODS

Generalities

The work presented here, summarises the information obtained in 3,353 visits to 765 different rabbitries, located in 41 Spanish provinces; data are shown in Table 1. The farms visited were of industrial or complementary type; the example of the 193 farms visited during the year 94, is representative: farms with 100 to 200 does in production: 12; with 201 to 300: 40; with 301 to 400: 37; with 401 to 500: 30; with 501 to 700: 28; with 701 to 1,000: 22; and farms with more than 1,000 does: 24. The biggest farm was visited the 4/10/93, and had, in that date, 7,200 females in production. The visits were performed by the author itself, or co-operatively with other veterinarian and NANTA specialists.
The visits were carried out by request of the producers, because of the existence of some problems or, in

difficult cases, by request of another veterinarian. In a small percentage, the visits were not the answers to a specific need of the owner; a rabbitry, almost always justifies a veterinarian's visit, though it is only useful just to know the technical or economical evolution of the business.

Table 1. General characteristics of the study: visits and necropsies.

Source/year	1989	1990	1991	1992	1993	1994	1995	TOTAL
Rabbitries visited	197	222	205	192	229	193	187	765*
Number of visits	650	521	435	463	470	401	414	3353
Rabbitries with necropsies	69	64	45	57	51	115	90	321*
Groups of necropsies	137	120	87	121	101	193	151	910

*This is the number of different rabbitries, not the total sum of the seven years.

During the 3353 visits, only in 910 occasions (27.1% of the visits) animals were necropsied, and that means in 321 of the 765 farms visited (42.0%).

As is indicated in Table 2, a total of 2140 necropsies were made in 321 rabbitries, with a total of 910 groups (2.3 animals by group), which consisted of 509 adult does, 38 young does (less than four months and a half), 24 adult males, 287 suckling rabbits (till 35 days, mean age for the weaning), and 1,282 weaned rabbits (between 35 and 65 days).

The causes for *post-mortem* examination were of two types: (a) in the study of subclinical processes, for example encephalitozoonosis, suspicious animals were sacrificed (cachectic, and without respiratory disorders neither diarrhoea); of 2,140 cases, 313 were sacrificed (14.6%) by this reason. (b) The remainder, 1,827 rabbits, were dead in the last 12 or 24 hours. Only a small number of animals were used to study the problem, therefore not always rabbits of all ages were necropsied, neither all dead animals were examined. In some cases, it was not possible to carry out a *post-mortem* examination because dead rabbits had been disposed off, or their conservation was not correct. In other cases, their examination was not necessary for the diagnosis.

Table 2. General characteristics of the study: necropsies.

Source/year	1989	1990	1991	1992	1993	1994	1995	TOTAL
Groups of necropsies	137	120	87	121	101	193	151	910
Total of necropsies	315	295	191	252	232	496	359	2140
Young females	7	4	1	6	7	6	7	38
Females	126	34	37	77	48	96	91	509
Males	8	4	4	3	1	1	3	24
Suckling rabbits	25	55	51	39	29	31	57	287
Weaned rabbits	149	198	98	127	147	362	201	1282

Procedures for the necropsy

In each case, the date, the characteristics of the farm (number of cages and number of females), and the production phase of the animals, in the cases were the record was available, were noted. Before necropsy, the animals were examined.

At the necropsy, the subcutaneous tissues, the organs of the thoracic and abdominal cavities, and, occasionally, some joint, nasal and ocular cavities, cranium and auditory channel, were observed. Necropsy findings were written in a schedule, together with the presumptive diagnosis. Eventually, samples were taken, and pictures were also taken of the cases of greatest interest.

The apparent causes of mortality were classified, according to macroscopic lesions, into respiratory, digestive or reproductive processes, viral haemorrhagic disease (VHD) and "others". The VHD was considered as an independent disease not related to other processes (for example myxomatosis), due to its importance in years 1989 and 1990. Pregnancy toxaemia was included in the reproductive group, although it is a disease that belongs to a group of metabolic diseases; it was made thus, to simplify this paper. Under the paragraph

"others", were included isolated cases and cases of unknown origin.
In the necropsies with mixed lesions, the author classified them according to the following criteria: compatible cases with pregnancy toxaemia (TG), but with simultaneous pneumonia lesions (PP), were considered as respiratory. The pneumonia and simultaneous enteritis, were classified as respiratory. Toxaemia and enteritis - diarrhoea (ED), were considered as digestive. Toxaemia and uterine torsion (TU), was classified as torsion; metritis (MET) and pneumonia, as respiratory; mastitis (M) and metritis, as mastitis (and in fact reproductive).

RESULTS AND DISCUSSION

Table 3 shows the *post-mortem* findings of all the necropsies. They reveal that the digestive pathology was the principal cause of mortality: 870 of the 1827 rabbits found dead (47.6%), followed by respiratory lesions: 483 cases (26.4%). LUND, 1951 (cited by OSTLER, 1961) found a 49.8% of enteritis on 3210 necropsies and a 27% of pneumonia; 45 years of difference, but the percentages were similar.

Table 3. Apparent causes of mortality in all the animals, n=2140.

Source /year	1989	1990	1991	1992	1993	1994	1995	TOTAL
Total necropsies.	315	295	191	252	232	496	359	2,140
Digestive	63	177	122	134	123	118	133	870
Respiratory	90	53	35	50	60	90	105	483
Reproductive	27	12	9	24	14	28	26	140
VHD	96	29	9	8	--	7	10	159
Other	39	24	16	46	35	253	85	488

As can be seen, in this classification simultaneous lesions in different organs are not described, but the presumptive cause of death is indicated according to the macroscopic lesions. However, other authors describe simultaneous lesions (LECERF, 1984).

Of the 488 cases classified as miscellaneous or unknown, 266 were weaned rabbits that had lesions consistent with encephalitozoonosis, of a total of 33 sacrificed by the author. Furthermore, there were 222 rabbits with other conditions or not diagnosed (10.3% of 2,140). Other authors had different percentages of animals without specific lesions, for example a 38.7% in the case of HINTON, 1979, or even a 54% (VÔRÔS, 1980).

Main causes of mortality in adult

Table 4 shows the results of the necropsies in males.

Table 4. Apparent causes of mortality in males, n=24.

Source/ year	1989	1990	1991	1992	1993	1994	1995	TOTAL
Total males	8	4	4	3	1	1	3	24
Respiratory	2	3	2	3	1	-	2	13
VHD	5	1	1	-	-	1	-	8
Myxomatosis	1	-	1	-	-	-	-	2
Other	-	-	-	-	-	-	1 ED	1

These values are insufficient to have a good criterion about the mortality in males, though it seems that there is a greater tendency in the death by respiratory disorders. As can be seen in Table 5, this pathology was also the principal cause of death in the females examined : 30%.

Table 5. Apparent causes of mortality in does, n=509.

Source/ year	1989	1990	1991	1992	1993	1994	1995	TOTAL
Total females	126	34	37	77	48	96	91	509
Respiratory	35	10	11	21	26	28	22	153
Reproductive	27	12	9	24	14	28	26	140
Digestive	10	5	5	15	7	18	27	87
VHD	43	6	6	5	-	6	7	73
Other	11	1	6	12	1	16	9	56

If the year 1989 (VHD) has not been included in this study, they would have been 383 (509-126) does dead. Of those, 118 (153-35) died from respiratory causes, in fact 118 of 383 (a 30.8%). The most important lesions in 153 females were in the lungs; in some occasions, they were associated with pleuritis, pericarditis, subcutaneous abscesses; as has been indicated in MATERIAL and METHODS, there were also cases of metritis and pneumonia simultaneously.

Table 6. Mortality in does by reproductive causes, n=140.

Source/ year	1989	1990	1991	1992	1993	1994	1995	TOTAL
Total reprod	27	12	9	24	14	28	26	140
Metritis	8	-	3	10	4	13	9	47
Mastitis	10	6	1	8	2	9	3	39
Preg toxaemia	6	5	3	5	6	4	1	30
Uter torsion	3	1	2	1	2	2	13	24

In table 6, it should be indicated that all the females examined in this group (a 27.5% of the total) were dead on the day of the visit, included those affected of mastitis, because it was of the acute type. In other groups (respiratory, digestive, VHD), the author found more than one doe that was dead by the same cause, in one farm. However, the simultaneous existence of a second female in the same rabbitry, dead by reproductive causes, only occurred in one occasion: two cases of uterine torsion.

There is no apparent cause that justifies 13 dead by uterine torsion in 1995, or 13 cases of metritis in 1994 and none in 1990. MAIRE, 1989,. found 115 females out of 347 (33.1%) with mastitis lesions, metritis and pyometra. It is a finding that can be considered similar to the one of the present study, because some cases of mastitis, metritis and pyometra were included as respiratory, if there was pneumonia. In the early '80, the cases of mastitis were more frequent than nowadays, because there was an increase of staphylococcal disease in rabbitries (RENAULT, 1981, ROSELL, 1995).

The remaining third of dead, is distributed in to the enteritis-diarrhoea (17.1%), between those which correspond to prevailing haemorrhagic typhlitis, VHD (14.3%), and others (11.0%). The VHD was very important in 1989, and since then its incidence was reduced. In an observation period of 7 years, the bias of the VHD is counteracted by the high number of necropsies.

In the miscellaneous group, "others", or unknown (56 animals), the following cases were observed: hepatopathies and nephropathies, as meaningful lesions; infestations by *P.ambiguus* (some cases had also pneumonia and were included in the respiratory disorders), myxomatosis, abortion, trichobezoar (some were included in digestive disorders, if there was enteritis), and furthermore a case of extra-uterine pregnancy.

38 young females were necropsied, with ages between two and a half months and four and a half months (never mated). Of 38 animals examined, 22 had a respiratory disorder (57.9%), 7 VHD, 6 enteritis-diarrhoea, and 3 unknown.

Apparent causes of mortality in suckling rabbits

The results are shown in Table 7. Apparently, digestive disorders were the main cause of mortality: 219 out of 287 (76.3%), versus the respiratory disorders (8.0%). There were 6 cases of VHD in two farms, with clinical and laboratory diagnosis; those animals were between 25 and 33 days old. They are mentioned in this paper, since the observation of nursing with VHD is exceptional, as is accepted by most of the experts. In the group of miscellaneous (39 animals), were included the following observations: suckling died by starvation and cold, by hyperthermal shock, staphylococcal infection and by unknown reasons.

Table 7. Causes of mortality in suckling rabbits, n=287.

Source/ year	1989	1990	1991	1992	1993	1994	1995	TOTAL
Tot suckling	25	55	51	39	29	31	57	287
Digestive	4	44	45	35	29	20	42	219
Respiratory	4	3	1	-	-	5	10	23
VHD	6	-	-	-	-	-	-	6
Other	11	8	5	4	-	6	5	39

The mortality of suckling rabbits during the period 1989-1995, was different from the one that the author found in the period 1981-1988 (ROSELL, 1990, Ph.D. Thesis, not published data). In that period there were much more cases of staphylococcal infection, though there were also digestive disorders; this findings are in accordance with the observations of OKERMAN, 1987. Mismothering seems not to be a big problem, as described in other surveys (WHITNEY *et al.*, 1976).

Apparent causes of mortality in weaned rabbits

They are those which appear in Table 8. There were a total of 1282 necropsies, 313 sacrificed and 969 found dead. 266 animals of the 313 that were slaughtered, all of them without previous symptoms of respiratory or digestive disorders, had gross lesions compatible with encephalitozoonosis, some others with respiratory lesions, but the majority were included in the group of 349 of miscellaneous (266 and 83). Obviously, the spontaneous mortality should be calculated from the total (1,282) less the 313 animals sacrificed, that is to say, 969 rabbits.

The principal cause of mortality was the digestive pathology: 561 of 969 (57.9%), followed by the respiratory: 300 of 969 (31.0%), VHD (7.4%) and "others". In the group of "others", of 349, 266 had compatible gross lesions with encephalitozoonosis (nephritis, splenomegaly and tumefactious mesenteric ganglia). Between the 83 remaining (6.4% of 1,282), there was myxomatosis, abscesses, joint lesions and unknown processes. In some sacrificed rabbits lesions compatible with cysticercosis were found, but no cases of hepatic coccidiosis were described; the last case was observed in 1985. LECERF found animals with hepatic coccidiosis during 1983, with an incidence of 2.5% in industrial rabbitries, and 38.5% in familiar units.

Table 8. Causes of mortality in weaned rabbits, n=1282.

Source/ year	1989	1990	1991	1992	1993	1994	1995	TOTAL
Tot weaned	149	198	98	127	147	362	201	1282
Digestive	49	128	72	84	85	80	63	561
Respiratory	49	37	21	32	33	57	71	300
VHD	42	22	2	3	-	-	3	72
Other	9	11	3	8	29	225	64	349

The weaned rabbit mortality due to VHD increased in 1989, in a similar way that occurred in adult rabbits. But in the last 6 years, the tendency seems to be stable. In adults, the respiratory processes prevail and, in young rabbits, digestive pathology is the most important. In a study of these characteristics, it would be interesting to include an etiological investigation.

CONCLUSIONS

- Digestive disorders and respiratory diseases were the main causes of death in necropsied rabbits in the field: 47.6% and 26.4% respectively.
- Respiratory and reproductive diseases were the most important in females: 30.0% and 27.5% respectively.
- Digestive disorders were the main causes of death in suckling rabbits: 76.3%.
- Weaned rabbits died with digestive (57.9%) or respiratory diseases (31.0%).

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