STUDIES ON THE LYMPHONODI OF CATS

I. MACROSCOPICAL OBSERVATIONS ON THE LYMPHONODI OF HEADS AND NECKS

Makoto SUGIMURA, Norio KUDO and
Kurahiko TAKAHATA

Laboratory of Veterinary Anatomy, Faculty of Veterinary Medicine, Hokkaido University, Sapporo, Japan

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INTRODUCTORY

Up to this time, even though there have been many anatomical studies on the lymphatic system done by numerous investigators, yet about the differences in structures depending on species which should be of interest in the phylogenetic studies the reports have been published by only a few investigators, such as GULLAND, SCHUMACHER, RICHTER, BUNTING, BAUM et al., JOLLY, GODBILLE, HEUDORFER and others, using various animals. Many other students have tended to deem the lymphonodi as the same in different animals.

Moreover, the differences in structure depending on location of node, which should be important for functional significations, were only affirmed by a few investigators, such as JOB, JORDAN et LOOPER, ASCHOFF and GYLLENSTEN, while DAWSON et MASUR denied any such fact.

Lately, HORII et al. distinguished "the primary lymphonodus" and "the secondary lymphonodus" — the former only receives directly the lymphatic vessels not passing through any other lymphonodus, while the latter receives the efferent lymphatic vessels of some other lymphonodus, — and reported the differences in producing power of lymphocytes and in structures between both types of lymphonodi.

In short, the differences in structure depending on animal species and the location of nodi have not been studied so thoroughly as to be recognized as distinctly proved. So, on these problems the writers hope to throw some light by means of comparative anatomical studies of the lymphatic system. Cats were selected for materials.

There were only a few macroscopical studies on the lymphatic system of cats, which were made by STROMSTEN, MANABE, MATSUMOTO, TAKESHITA, TOMITA, REIGHARD et JENNINGS and others.

In this paper the appearances of the afferent and efferent lymphatic vessels of each node and the varieties of lymphonodi concerning to their vessels are

described. For convenience, the study is limited particularly to those of heads and necks.

Materials and Methods

The writers used for this research 21 cats, aged 15 days to 7 years, as indicated in table 1.

TABLE 1. *Materials Used for This Observation*

EXP. NO.	SEX	AGE	WEIGHT (g)
1	♂	1 Month	200
2	"	3 Months	560
3	"	3 "	700
4	"	4.5 "	1050
5	"	?	1800
6	"	2 Years	2800
7	"	3 "	3800
8	"	6 "	3500
9	"	6 "	4750
10	"	7 "	4600
11	♀	15 Days	200
12	"	1 Month	180
13	"	1 "	210
14	"	1.5 Months	410
15	"	4 "	1500
16	"	5 "	1350
17	"	1 Year	2400
18	"	2 Years	3200
19	"	3 "	1800
20	"	4 "	2250
21	"	6 "	3300

The materials were anesthetized and killed by ether. Double solution of India ink bought on the market was injected into various parts of heads and necks before the temperature of the body had declined, for the purpose of observating the afferent and efferent lymphatic vessels as accurately as possible.

For injections, the writers used an injection-syringe of 2ml capacity and a needle of 1/4 mm in diameter on sale in ordinary medical supply shops.

In addition to India ink, the writers also used 4% solution of carmine, 10% solution of cinnabar and about 4% solution of Berlin blue which they themselves prepared. Ten

% solution of cinnabar was useless to make clear the lymphatic vessels, and other coloring matters leaked out of the lymphatic vessels. But only with Berlin blue were somewhat good results gained. After all, the India ink was the best injection matter.

In the present paper, the descriptions of venous system accompanied with lymphatic systems are made with reference to HIROTA's report and the names are given in accord with the *Nomina Anatomica Japonica.*

RESULTS

1. Groups of Lymphonodi in Heads and Necks

The lymphonodi of heads and necks were distinguished into 10 groups according to their positions. The groups were named provisionally as follows:

1) *Lymphonodi submandibulares mediales*; These nodi, of 2.4~0.25 cm in the longest diameter, touch in front of the union of *V. facialis* and *V. transversa hyoidea* lying beneath platysma. They were flatly ellipsoid-shape.

2) *Lymphonodi submandibulares laterales*; These nodi, of 1.9~0.38 cm in the longest diameter, touch in front of the union of *V. retromandibularis* and *V. facialis*, lying beneath platysma. Most of these nodi were depressed with ellipsoid-shape.

3) *Lymphonodi submandibulares mediales caudales*; These small nodi, of 0.35~0.05 cm in the longest diameter, were scattered about the juncture of *V. transversa hyoidea* with *V. facialis* being situated behind foregoing *Lnn. submandibulares med.* They were spherical.

4) *Lymphonodi submandibulares laterales caudales*; These were also small nodi, of 0.36~0.05 cm in the longest diameter, which were scattered about the juncture of *V. retromandibularis* with *V. facialis* lying behind foregoing *Lnn. submandibulares lat.* They were also spherical.

5) *Lymphonodi parotidici craniales*; These nodi, of 0.86~0.1 cm in the longest diameter, were embedded in *Gl. parotis* lying along *V. temporalis communis.* Most of these forms were somewhat depressed with round outlines.

6) *Lymphonodi parotidici caudales*; These nodi, of 3.1~0.05 cm in the longest diameter, were mostly club-shaped, but partly gourd-shaped or rounded and embedded in fatty tissues lying behind *Gl. parotis*, along *V. retroauricularis* and *V. retromandibularis.*

7) *Lymphonodi retropharyngici*; These nodi, of 2.25~0.15 cm in the longest diameter, were found along *V. jugularis interna* lying behind the pharynx. Lymphonodi of this group were the largest nodi in head and neck regions and mostly kidney-shaped.

8) *Lymphonodi cervicales superficiales dorsales*; These nodi, of 3.22~0.1 cm in the longest diameter, were embedded in the fatty tissues lying beneath *M. trapezius cervicalis* and *M. omotransversarius*, along *V. transversa colli.* Most of these nodi were flatly ellipsoid-shaped, but partly gourd-shaped.

9) *Lymphonodi cervicales superficiales ventrales*; These nodi, of 1.46~0.08 cm in the longest diameter, were partly covered by the union of *V. jugularis externa* and *V. transversae colli* and embedded in the fatty tissues. Their forms were mostly oval.

10) *Lymphonodus cervicalis profundus*; This small rounded nodus, of 0.45~0.1 cm in the longest diameter, was found along *V. jugularis interna* lying beside the trachea of the neck region.

TABLE 2. *Number of Lymphonodi Appearing in Each Group of Lymphonodi*

GROUPS OF LYMPHONODI		EXPERIMENT NO. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	TOTAL	AVERAGE
Submandibulares med.	R	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	44	1.05 ± 0.22
	L	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1		
Submandibulares lat.	R	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	43	1.02 ± 0.15
	L	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Submandibulares med. caud.	R	·	1	·	·	1	1	·	1	·	1	1	·	1	·	·	·	1	2	2	·	1	29	1.26 ± 0.45
	L	·	2	1	1	2	·	1	1	·	2	·	·	2	·	·	1	1	1	1	·	·		
Submandibulares lat. caud.	R	·	·	1	1	2	·	1	3	·	1	1	1	1	·	2	1	2	1	·	1	·	36	1.33 ± 0.55
	L	·	2	1	1	1	·	·	2	·	1	1	·	1	·	·	2	2	1	1	1	·		
Parotidici cran.	R	1	1	2	1	1	1	1	1	·	1	1	1	1	1	·	1	1	·	1	2	1	41	1.14 ± 0.35
	L	2	1	1	1	1	1	1	1	·	1	·	1	1	·	1	2	2	1	1	1	1		
Parotidici caud.	R	2	4	5	2	3	4	5	3	3	3	3	6	4	2	1	5	2	5	2	4	3	152	3.62 ± 1.5
	L	3	2	4	4	3	6	2	7	4	3	5	6	7	3	3	4	1	5	2	4	3		
Retropharyngici	R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	43	1.02 ± 0.15
	L	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1		
Cervicales superficiales dors.	R	2	3	2	3	3	3	2	3	2	2	2	2	2	2	2	2	2	1	3	2	2	88	2.1 ± 0.46
	L	2	2	2	2	2	3	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2		
Cervicales superficiales vent.	R	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	45	1.1 ± 0.28
	L	1	1	1	·	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1		
Cervicalis prof.	R	·	1	·	·	1	1	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	5	1.0 ± 0
	L	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·		
Total of Each Side	R	9	14	14	11	15	15	13	15	9	12	12	16	13	9	11	13	12	13	12	13	11		
	L	11	13	13	12	15	14	10	17	9	13	12	13	18	9	11	15	12	14	11	12	10	526	* 25.1 ± 4.02
Total of Both Sides		20	27	27	23	30	29	23	32	18	25	24	29	31	18	22	28	24	27	23	25	21		

Remarks: R: Right side. L: Left side. Average: Average number of lymphonodi on an individual side. *: Average number of lymphonodi on an individual.

2. The Numbers of Lymphonodi

The number of lymphonodi found in heads and necks were distributed into the above-mentioned groups of lymphonodi, as indicated in table 2.

It should be noted with regard to the number of lymphonodi found in heads and necks that the writers could not indicate the differences by individuals, sexes, ages or between right and left sides. But only *Lnn. parotidici caud.*, on an average 3.62 ± 1.5, have shown conspicuous variation of the number.

3. The Existence Ratio of Each Group

In observed 42 sides, each group has been found as indicated in table 3.

TABLE 3. *Showing the Ratio of Existence of Each Group*

GROUP OF LYMPHONODI	*Submandibulares med.*	*Submandibulares lat.*	*Parotidici caud.*	*Retropharyngici*	*Cervicales superficiales dors.*	*Cervicales superficiales vent.*	*Parotidici cran.*	*Submandibulares lat. caud.*	*Submandibulares med. caud.*	*Cervicalis prof.*
NUMBERS OF SIDES FOUND LYMPHONODI	42	42	42	42	42	41	36	27	23	5
NUMBERS OF SIDES SEARCHED FOR LYMPHONODI	42	42	42	42	42	42	42	42	42	42
EXISTENCE RATIOS (%)	100	100	100	100	100	97.6	85.7	64.3	54.8	11.9
GROUPS DIFFERENTIATED BY RATIO OF OCCURRENCE	Constant					Nearly Constant		Inconstant		

According to the ratio of existence, each group of lymphonodi has been classified into 3 groups as follows;

1) Group of constant existence (existence ratio of 100%); This includes *Lnn. submandibulares med.*, *Lnn. submandibulares lat.*, *Lnn. parotidici caud.*, *Lnn. retropharyngici* and *Lnn. cervicales superficiales dors.*

2) Group of nearly constant existence (existence ratio less than 100% but over 80%); This includes *Lnn. cervicales superficiales vent.* and *Lnn. parotidici cran.*

3) Group of inconstant existence (existence ratio less than 80%); This includes *Lnn. submandibulares med. caud.*, *Lnn. submandibulares lat. caud.* and *Ln. cervicalis prof.*

4. The Areas of Origin of Afferent Lymphatic Vessels

Each group of the above-named lymphonodi received lymphatic vessels whose sources were found at respectively corresponding areas in heads and necks, as indicated in table 4.

TABLE 4. *Showing the Appearances of Areas of Origin of Afferent Lymphatic Vessels Which Entered into Each of Lymphonodi*

GROUPS OF LYMPHONODI		REGIONS OF ORIGIN OF AFFERENT LYMPHATIC VESSELS																														
		Surface of Platysma	Auricula	Caput	Reg. palpebralis sup.	Reg. palpebralis inf.	Reg. labialis maxillaris	Reg. labialis mandibularis	Reg. mentalis	Subcutis of Reg. colli dors.	Subcutis of Reg. colli vent.	Aponeurosis of Collum	Extremitas thorac.	Reg. sternalis	Lingua	Cavum oris	Gl. buccalis	Gl. submandibularis	Gl. parotis	Gl. thyreoidea	Trachea	Oesophagus	Lnn. submandibulares med.	Lnn. submandibulares lat.	Lnn. submandibulares med. caud.	Lnn. submandibulares lat. caud.	Lnn. parotidici cran.	Lnn. parotidici caud.	Lnn. retropharyngici	Lnn. cervicales superficiales dors.	Lnn. cervicales superficiales vent.	Ln. cervicalis prof.
Submandibulares med.	F	.	.	.	.	1	7	42	42	.	.	.	.	.	.	1	42	.	.	.	.	.	2	22	.	.	.	.	.	.	.
	S	.	.	.	.	42	42	42	42	.	.	.	.	.	.	42	42	.	.	.	.	.	42	40	.	.	.	.	.	.	.
	%	.	.	.	.	2.4	16.7	100.0	100.0	.	.	.	.	.	.	2.4	100.0	.	.	.	.	.	4.8	55.0	.	.	.	.	.	.	.
Submandibulares lat.	F	.	.	.	31	36	42	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30	.	.	1	1	33	.	.	.	.
	S	.	.	.	42	42	42	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	41	.	.	42	42	42	.	.	.	.
	%	.	.	.	73.8	85.7	100.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	73.2	.	.	2.4	2.4	78.6	.	.	.	.
Submandibulares med. caud.	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23	5	3	1	.	.	.	.	.	.
	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23	23	23	23	.	.	.	.	.	.
	%	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	21.7	13.0	4.5	.	.	.	.	.	.
Submandibulares lat. caud.	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	27	.	5	.	22	.	.	.	.
	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	27	27	.	27	.	27	.	.	.	.
	%	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22.2	100.0	.	18.5	.	81.5	.	.	.	.
Parotidici cran.	F	.	.	35	35	4	.	.	.	.	.	.	.	.	.	.	.	.	32	.	.	.	.	.	.	.	5	6	.	.	.	.
	S	.	.	35	36	36	.	.	.	.	.	.	.	.	.	.	.	.	32	.	.	.	.	.	.	.	36	36	.	.	.	.
	%	.	.	100.0	97.2	11.4	.	.	.	.	.	.	.	.	.	.	.	.	100.0	.	.	.	.	.	.	.	13.9	16.7	.	.	.	.
Parotidici caud.	F	3	42	27	33	17	1	1	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	6	.	1	34	36	.	.	.	.
	S	42	42	39	42	42	42	42	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	42	.	42	42	41	.	.	.	.
	%	7.4	100.0	69.2	78.6	40.5	2.4	2.4	.	.	.	.	.	.	.	.	.	.	100.0	.	.	.	.	14.3	.	2.4	81.0	85.7	.	.	.	.
Retropharyngici	F	.	.	.	.	.	.	.	.	.	.	37	.	.	42	31	.	36	2	37	36	39	40	24	17	9	2	10	1	.	.	.
	S	.	.	.	.	.	.	.	.	.	.	37	.	.	42	31	.	36	36	37	36	39	40	42	40	42	39	40	40	.	.	.
	%	.	.	.	.	.	.	.	.	.	.	100.0	.	.	100.0	100.0	.	100.0	5.6	100.0	100.0	100.0	100.0	57.1	42.5	21.4	5.1	25.0	2.5	.	.	.
Cervicales superficiales dors.	F	5	.	.	.	.	.	.	.	42	.	40	42	.	.	.	.	.	.	.	.	.	1	2	1	1	.	12	10	39	36	.
	S	42	.	.	.	.	.	.	.	42	.	40	42	.	.	.	.	.	.	.	.	.	42	42	42	42	.	42	42	41	42	.
	%	11.9	.	.	.	.	.	.	.	100.0	.	100.0	100.0	.	.	.	.	.	.	.	.	.	2.4	4.8	2.4	2.4	.	28.6	23.8	95.1	85.7	.
Cervicales superficiales vent.	F	.	.	.	.	.	.	.	.	.	41	35	.	27	.	.	.	.	.	.	.	.	41	41	22	26	.	41	5	5	4	.
	S	.	.	.	.	.	.	.	.	.	41	35	.	27	.	.	.	.	.	.	.	.	41	41	41	41	.	41	41	41	41	.
	%	.	.	.	.	.	.	.	.	.	100.0	100.0	.	100.0	.	.	.	.	.	.	.	.	100.0	100.0	53.7	63.4	.	100.0	12.2	12.2	9.8	.
Cervicalis prof.	F	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	5	5	5	.	.	.	.	.	.	5	.	.	.
	S	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	5	5	5	.	.	.	.	.	.	5	.	.	.
	%	.	.	.	.	.	.	.	.	.	.	100.0	.	.	.	.	.	.	.	100.0	100.0	100.0	.	.	.	.	.	.	100.0	.	.	.

Remarks: F. Number of sides where area of origin was found.
S. Number of sides where area of origin was sought.

That is;

1) *Lnn. submandibulares med.* in all cases receive lymphatic vessels which arise from *Reg. labialis mandibularis*, *Reg. mentalis* and *Gl. buccalis*, in some cases from *Reg. palpebralis inf.*, *Reg. labialis maxillaris* and *Cavum oris*, in many cases also efferent lymphatic vessels of *Lnn. submandibulares lat.* and in few cases those from nodi of the same group.

2) *Lnn. Submandibulares lat.* in all cases receive lymphatic vessels which begin from *Reg. labialis maxillaris*, and in a majority of cases they receive those from *Reg. palpebralis sup. et inf.*, and efferent lymphatic vessels which arise from *Lnn. submandibulares med.* and *Lnn. parotidici caud.* In only a few cases these lymphonodi were seen to receive the vessels from *Lnn. parotidici cran.* and *Lnn. submandibulares lat. caud.*

3) *Lnn. submandibulares med. caud.* in all cases receive efferent lymphatic vessels of *Lnn. submandibulares med.*, in some cases those from *Lnn. submandibulares lat.*, *Lnn. submandibulares lat. caud.* and nodi in this group, but never does it receive other lymphatic vessels than efferent lymphatic vessels of other lymphonodi.

4) *Lnn. submandibulares lat. caud.* in all cases receive efferent lymphatic vessels of *Lnn. submandibulares lat.*, a majority of cases receive those from *Lnn. parotidici caud.* and partly *Lnn. submandibulares med.* and from nodi in this group. In this group it was noted that only efferent vessels of certain lymphonodi enter into lymphonodi of this group.

5) *Lnn. parotidici cran.* in all cases receive lymphatic vessels which arise from *Caput* and *Gl. parotis*, in a majority of cases, those from *Reg. palpebralis sup.* and in some cases those from *Reg. palpebralis inf.* Efferent lymphatic vessels of *Lnn. parotidici caud.* and nodi in this group rarely enter into these lymphonodi.

6) *Lnn. parotidici caud.* in all cases receive lymphatic vessels which arise from *Auricula* and *Gl. parotis*, in some cases those from surface of *Platysma*, *Caput* and *Reg. palpebralis sup. et inf.*, and *Reg. labialis maxillaris et mandibularis.* A majority of cases in this group receive efferent lymphatic vessels of *Lnn. parotidici cran.* and nodi in this group, in some cases those from *Lnn. submandibulares lat.* and *Lnn. submandibulares lat. caud.*

7) *Lnn. retropharyngici* in all cases receive lymphatic vessels which arise from *Aponeurosis* of *Collum*, *Lingua*, *Cavum oris*, *Gl. submandibularis*, *Gl. thyreoidea*, *Trachea*, *Oesophagus* and *Lnn. submandibulares med.*, and in some cases those from *Gl. parotis* and efferent lymphatic vessels of *Lnn. submandibulares lat.*, *Lnn. submandibulares med. caud.* and *Lnn. submandibulares lat. caud.* They also receive efferent lymphatic vessels of *Lnn. parotidici cran.* and *Lnn. parotidici caud.* Efferent lymphatic vessels of some nodi in this group enter into other nodi of this group.

8) *Lnn. cervicales superficiales dors.* in all cases receive lymphatic vessels which arise from the subcutis of *Reg. colli dors.*, *Aponeurosis* of *Collum* and *Extremitas thoracica*, mostly efferent lymphatic vessels of *Lnn. cervicales superficiales vent.* and other nodi of this group, and in some cases those of *Lnn. retropharyngici* and *Lnn. parotidici caud.* In few cases they receive lymphatic vessels which begin from surface of *Platysma.* In case of lacking *Lnn. cervicales superficiales vent.*, the efferent lymphatic vessels of *Lnn. submandibulares med.*, *Lnn. submandibulares lat.*, *Lnn. submandibulares med. caud.* and *Lnn. submandibulares lat. caud.* enter into *Lnn. cervicales superficiales dors.*

In this group, 2 nodi in contact or a gourd-shaped nodus were often found, and the upper nodus in such 2 nodi or the upper part of the gourd-shaped nodus receives efferent lymphatic vessels of *Lnn. parotidici caud*, while the lower part receives lymphatic vessels which begin from *Extremitas thoracica* and *Lnn. cervicales superficiales vent.*

9) *Lnn. cervicales superficiales vent.* in all cases receive lymphatic vessels which arise from the subcutis of *Reg. colli vent.*, *Aponeurosis* of *Collum* and *Reg. sternalis* and efferent lymphatic vessels of *Lnn. submandibulares med.*, *Lnn. submandibulares lat.* and *Lnn. parotidici caud.*, and in some cases they receive those from *Lnn. retropharyngei*, *Lnn. cervicales superficiales dors.* and other lymphonodi of this group. When *Lnn. submandibulares med. caud.* and *Lnn. submandibulares lat. caud.* are present, the efferent lymphatic vessels from them enter in all cases into lymphonodi of this group.

10) *Ln. cervicalis profundus* in all cases receives lymphatic vessels which arise from *Aponeurosis* of *Collum*, *Gl. thyreoidea*, *Trachea*, *Oesophagus* and *Lnn. retropharyngici.*

5. Classification of Lymphonodi According to the Sources of Afferent Lymphatic Vessels

Afferent lymphatic vessels of a lymphonodus have been differentiated into 2 types according to their sources: (a) lymphatic vessels which do not pass through nodi, (b) the efferent lymphatic vessels of some nodi.

The writers have classified lymphonodi into 3 types according to the state of above-mentioned lymphatic vessels, as follows;

Type Z: Lymphonodus which has solely (a).
Type T: Lymphonodus which has solely (b).
Type ZT: Lymphonodus which has both (a) and (b).

TABLE 5. *Number of Writers' Proposed 3 Types Found in Each Group of Lymphonodi*

GROUPS OF LYMPHONODI	TYPES OF LYMPHONODI						TOTAL	
	Z		Z T		T			
	Cases	%	Cases	%	Cases	%	Cases	%
Submandibulares med.	17	40.5	24	57.1	1	2.4	42	100.0
Submandibulares lat.	2	4.6	41	95.4	•	•	43	100.0
Submandibulares med. caud.	•	•	•	•	22	100.0	22	100.0
Submandibulares lat. caud.	•	•	•	•	26	100.0	26	100.0
Parotidici cran.	29	70.7	11	26.8	1	2.5	41	100.0
Parotidici caud.	12	8.3	128	88.2	5	3.5	145	100.0
Retropharyngici	•	•	42	97.7	1	2.3	43	100.0
Cervicales superficiales dors.	2	2.3	79	90.8	6	6.9	87	100.0
Cervicales superficiales vent.	•	•	43	95.6	2	4.4	45	100.0
Cervicalis prof.	•	•	5	100.0	•	•	5	100.0

6. The Numbers of the Proposed 3 Types of Lymphonodi

The observed numbers of each type of lymphonodi in each group are set out in table 5.

In *Lnn. submandibulares med.* 24 cases among 42 (57.1%) have been taken by type ZT, 17 cases (40.5%) by type Z and only one case (2.4%) by type T.

In *Lnn. submandibulares lat.*, the majority of cases (41 cases among 43) (95.4%) have been taken by type ZT and only 2 cases (4.6%) by type Z.

In *Lnn. submandibulares med. caud.* and *Lnn. submandibulares lat. caud.*, all were found to be type T.

In *Lnn. parotidici cran.*, the majority of cases (29 cases among 41) (70.7%) have been taken by type Z, 11 cases (26.8%) by type ZT and only one case (2.5%) by type T.

In *Lnn. parotidici caud.*, the majority of cases (128 cases among 145) (88.2%) were type ZT, 12 cases (8.3%) were type Z and 5 cases (3.5%) were type T.

In *Lnn. retropharyngici*, the majority of cases (42 cases among 43) (97.7%) were found to be type ZT and only one case (2.3%) was type T.

In *Lnn. cervicales superficiales dors.*, the majority of cases (79 cases among 87) (90.8%) were type ZT, 6 cases (6.9%) were type T and only 2 cases (2.3%) were type Z.

In *Lnn. cervicales superficiales vent.*, the majority of cases (43 cases among 45) (95.6%) were type ZT and only 2 cases (4.4%) type T.

In *Ln. cervicalis prof.*, all were type ZT.

TABLE 6. *Types of Communication in Each Group of Lymphonodi*

	GROUP OF LYMPHONODI	TYPES OF COMMUNICATION A Cases	A %	B Cases	B %	C Cases	C %	TOTAL Cases	TOTAL %
In	*Submandibulares med.*	·	·	·	·	1	100.0	1	100.0
In	*Parotidici cran.*	1	100.0	·	·	·	·	1	100.0
In	*Parotidici caud.*	5	17.2	2	6.9	22	75.9	29	100.0
In	*Cervicales superficiales dors.*	4	18.2	6	27.3	12	54.5	22	100.0
Between	*Submandibulares med.* and *lat.*	1	4.8	5	23.8	15	71.4	21	100.0
Between	*Submandibulares lat. and lat. caud.*	1	50.0	1	50.0	·	·	2	100.0
Between	*Submandibulares lat.* and *Parotidici caud.*	1	20.0	3	60.0	1	20.0	5	100.0
Between	*Parotidici cran.* and *caud.*	1	12.5	1	12.5	6	75.0	8	100.0
Between	*Cervicales superficiales dors.* and *vent.*	·	·	1	50.0	1	50.0	2	100.0
	Total	14	14.6	19	21.3	58	64.1	91	100.0

7. About the Communications between Adjacent Lymphonodi by Lymphatic Vessels Which Allow Reversible Lymph Stream

In many cases, it was found that communication by lymphatic vessels between adjacent lymphonodi. The forms of communication were 3 types, as follows;

Type A: the communication consists of only 1 lymphatic vessel through which reversible flow could occur.

Type B: the communication consists of 2 or more lymphatic vessels with distinct single flowing direction.

Type C: the communication consists of the plexus of lymphatic vessels connecting among lymphonodi with unconstant flowing directions.

The groups of lymphonodi with each type of the communication are indicated in table 6.

Out of 91 cases of the communication found in this observation, 29 cases have been found in *Lnn. parotidici caud.*, 22 cases in *Lnn. cervicales superficiales dors.* and only 1 in each *Lnn. submandibulares med.* and *Lnn. parotidici cran.*, moreover, 21 cases between *Lnn. submandibulares med.* and *Lnn. submandibulares lat.*, 8 cases between *Lnn. parotidici cran.* and *Lnn. parotidici caud.*, 5 cases between *Lnn. submandibulares lat.* and *Lnn. parotidici caud.*, 2 cases between *Lnn. submandibulares lat.* and *Lnn. submandibulares lat. caud.* and also 2 cases between *Lnn. cervicales superficiales dors.* and *Lnn. cervicales superficiales vent.*

As indicated in above described results, the communications of lymph among lymphonodi have been found largely within the writers' group of lymphonodi, while some have been found between lymphonodi of different groups.

The majority of these have been found in *Lnn. parotidici caud.*, *Lnn. cervicales superficiales dors.* and between *Lnn. submandibulares med.* and *Lnn. submandibulares lat.* In passages of these efferent lymphatic vessels the writers have found many lymphonodi of type T.

In *Lnn. parotidici caud.*, 22 cases among 29 (75.7%) have found to belong to type C, 5 cases (17.2%) to type A and only 2 cases (6.9%) to type B.

In *Lnn. cervicales superficiales dors.*, 12 cases among 22 (54.5%) have been found to be type C, 6 cases (27.3%) to type B and 4 cases (18.2%) to type A.

In *Lnn. submandibulares med.*, type C has been found only 1 case.

In *Lnn. parotidici cran.*, type B has been found only 1 case.

Out of 21 cases of communication found between *Lnn. submandibulares med.* and *Lnn. submandibulares lat.*, 15 cases (71.4%) have been found to belong to type C, 5 cases (23.8%) to type B and only 1 (4.8%) to type A.

In cases of communication between *Lnn. parotidici cran.* and *Lnn. parotidici caud.*, 6 cases among 8 (75%) have been found to be type C and 1 each case (each 12.5%) to be types A and B.

In communications between *Lnn. submandibulares lat.* and *Lnn. parotidici caud.*, 3 cases among 5 (60%) have been found to be type B and each 1 case (each 20%) to be types

A and C.

In communications between *Lnn. submandibulares lat.* and *Lnn. submandibulares lat. caud.*, types A and B have been found each 1 case (each 50%).

In communications between *Lnn. cervicales superficiales dors.* and *Lnn. cervicales superficiales vent.*, types B and C have been found each 1 case (each 50%).

DISCUSSION

In this paper, the writers have classified the observed lymphonodi into 10 groups according to their positions.

With regard to *Lnn. submandibulares med. caud.* and *Lnn. submandibulares lat. caud.*, MANABE, REIGHARD et JENNINGS, STROMSTEN, WILLIAM et RICHARD and others have not reported. As each of these unrecorded groups has been found at the rate of 54.8% and 64.3%, the writers have treated them as 1 group. According to previous authors' reports, it was thought these groups of lymphonodi should be included in *Lnn. submandibulares med.* and *Lnn. submandibulares lat.* respectively.

Ln. cervicalis profundus, found along *V. jugularis interna* and beside the trachea, was not also found in above reports relative to cats. From the positions of these lymphonodi, even though found in only 5 sides amongst 42 (11.9%), they are thought to correspond to the anterior, middle or posterior cervical lymphonodus in dogs (SISSON). In cats they were found at all scopes beside neck trachea. According to the above description, as these lymphonodi were thought to belonged to *Lc. cervicale profunda* in other animals, they were provisionally named *Ln. cervicalis profundus*.

GULLAND classified lymphonodi into 3 according to the order in which they appear. That is "primary lymphatic gland" which are the first to develop and are all fully developed in foetal life, "secondary lymphatic gland" which are developed in some animals in foetal life, in others not till after birth and "tertiary lymphatic gland" which are formed in adult life on some special occasion, such as during the exceptional activity of some organs or in pathological conditions.

The writers have classified lymphonodi into 3 groups of constant, nearly constant and inconstant existence according to the difference of ratios at which they exist. Viewing these data it seems clearly that the ratios of the existence of lymphonodi differ according to position.

In the writers' 2 groups of nearly constant and inconstant existence, no definite tendency of their appearance has been found in connection with ages. But that will not allow the conclusion that writers' nearly constant and inconstant groups and GULLAND's "tertiary lymphatic gland" are the same. At least, writers' nearly constant group is under suspicion of being abnormal one. The inconstant one which is comparatively small may be the same thing as GULLAND's "tertiary lymphatic gland".

In the present paper, the writers have stated that the numbers of lymphonodi do not particularly vary by individuals, sexes, ages and between right and left sides, but in their groups of lymphonodi, only *Lnn. parotidici caud.* has clearly shown a variation of numbers.

For the purpose of determining the source of lymph which enter into each lymphonodus, the starting areas of their afferent lymphatic vessels have been inspected; it was found that each starting area was correlated respectively to each group of lymphonodi.

It has been found that each lymphonodus acts as a "collecting place of lymph" (writers' type Z), "transporting station of lymph" (type T) or a place with dual function (type ZT). Each type was shown a different tendency in each of the writers' groups of lymphonodi.

HORII et TAMAKI reported the difference of their so-called primary and secondary lymphonodi.

The present writers have differentiated 3 types of lymphonodi. Their type Z corresponds to HORII's primary lymphonodi, and types T and ZT to the secondary lymphonodi. Lymphonodi of type T are constantly small and exist only in contact behind other lymphonodi, of which the efferent lymphatic vessels enter into lymphonodi of type T.

JOB considers that small lymphonodi (so-called "accessory node"), which he had found always in contact with the usually existed lymphonodi in lymphocenter, appear in pathological conditions.

JORDAN et LOOPER stated that such a lymphonodus is found in contact with degenerating lymphonodi.

HORII et al. reported that these small nodi are related with the regeneration of lymphonodi.

SUZUKI and KOIZUMI, using humans and rabbits for material, reported that lymphatic apparatus reaching from small lymphonodus to infiltrations of lymphocytes appears in the fatty tissues of lymphocenter, and further with increase in age, generally more lymphonodi appear than infiltrations of lymphocytes.

If the lymphonodi of present writers' type T were the same thing as the above described investigator's "accessory node" or small lymphonodi in fatty tissues, it should be of interest to note the fact that these lymphonodi are very small and act as only "transporting station of lymph".

In this observation, the writers have noted the communications of lymph between lymphonodi by lymphatic vessels. According to the styles of the communications the writers have classified them into 3 types A, B and C. It was found that communication exists within writers' one group of lymphonodi, and even between those of other groups.

ANDO found lymphonodi which are connected with only the capsula and considered that these were the incomplete cases of multiplication.

GULLAND was of the opinion that in the developmental processes of lymphonodi, the lymphatic vessels of the plexus had not entered into the composition of the node at all, and some of them remained to form an external sinus, but the others had been utilized merely as communication between node and node, as the afferent and efferent vessels.

The majority of these phenomena have especially been found in writers' *Lnn. parotidici caud.*, which have clearly shown great individual deviation in number of nodi; they have also been found in *Lnn. cervicales superficiales dors.*, in which gourd-shaped nodi have often appeared. For these reasons, it is thought that some of these communications have some relationship to the multiplication of lymphonodi.

On the other hand, between the writers' *Lnn. submandibulares med.* and *Lnn. submandibulares lat.*, which are described as appearing each from different anlage by ANDO, many communications have also been found. In these cases, these communications will probably be the same thing as GULLAND's remainder of lymphatic vessels of plexus. ANDO stated that *Lnn. cervicales dors.* were developed from the cystic lymphonodus anlage, and the writers have seen the communications in such lymphonodi. The present writers have, therefore, thought that these communications were not always the same things as GULLAND's one.

The majority of cases of communications were type C, with types A and B appearing rather seldom. Most of type A, which have almost all been found in *Lnn. parotidici caud.* and in *Lnn. cervicales superficiales dors.*, were thought to be the same thing as the connection of only randsinus according to ANDO's paper, because the writers have found the gourd-shaped lymphonodi in both groups. Most of types B and C were thought to be the same thing as the remainder of plexus of lymphatic vessels in the developmental process of lymphonodi according to GULLAND's opinion about lymphonodi development. Type B seemed to be a more advanced form than type C.

It is interesting that most of the lymphonodi of writers' type T have been found in passages of efferent lymphatic vessels starting to lymphonodi which have great many communicating vessels.

SUMMARY

The writers have macroscopically observed the lymphonodi in heads and necks, using 21 cats for materials.

In conclusion, it may be well to summarize briefly the results at which the writers have arrived;

1. The lymphonodi were classified into 10 groups according to position as follows: *Lnn. submandibulares med., Lnn. submandibulares lat., Lnn. submandibulares med. caud., Lnn. submandibulares lat. caud., Lnn. parotidici cran., Lnn. parotidici caud., Lnn. retropharyngici, Lnn. cervicales superficiales dors., Lnn. cervicales superficiales vent.* and *Ln. cervicalis prof.*

2. No numerical difference of lymphonodi has been found by individuals, sexes, ages or between the right and left sides. About each group of lymphonodi, however, *Lnn. parotidici caud.* have shown conspicuous variation in number.

3. Arising from the difference of these existing ratios, the writers' 10 groups of lymphonodi have been divided in 3 groups of constant, nearly constant and inconstant existence.

4. Each of the starting areas of afferent lymphatic vessels has been correlated respectively to each of the writers' grouping of the lymphonodi.

5. The writers have classified lymphonodi into 3 types of Z, T and ZT according to the states of their afferent lymphatic vessels and found that these types appear with different tendency in each group of lymphonodi.

6. In many cases, the writers have found the communication of lymph among lymphonodi by lymphatic vessels and by these styles of communication have divided them into 3 types of A, B and C. These types of communication have been found in writers' groups of lymphonodi, and even between those of another.

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EXPLANATION OF PLATE

References Common to Figs. 1 and 2

a: *Lnn. submandibulares mediales.*
b: *Lnn. submandibulares laterales.*
c: *Lnn. submandibulares mediales caudales.*
d: *Lnn. submandibulares laterales caudales.*
e: *Lnn. parotidici craniales.*
f: *Lnn. parotidici caudales.*
g: *Lnn. retropharyngici.*
h: *Lnn. cervicales superficiales dorsales.*
i: *Lnn. cervicales superficiales ventrales.*
j: *Ln. cervicalis profundus.*
I: *V. jugularis communis.*
II: *V. jugularis externa.*
III: *V. jugularis interna.*
IV: *V. transversa colli.*
V: *V. facialis.*
VI: *V. transversa hyoidea.*
VII: *V. retromandibularis.*
VIII: *V. temporalis communis.*
IX: *V. retroauricularis.*

FIG. 1. *Superficial Lymphonodi, Lymphatic Vessels (Black Line) and Veins (Stipple) Accompanied with Lymphatic Vessels Shown Diagrammatically*

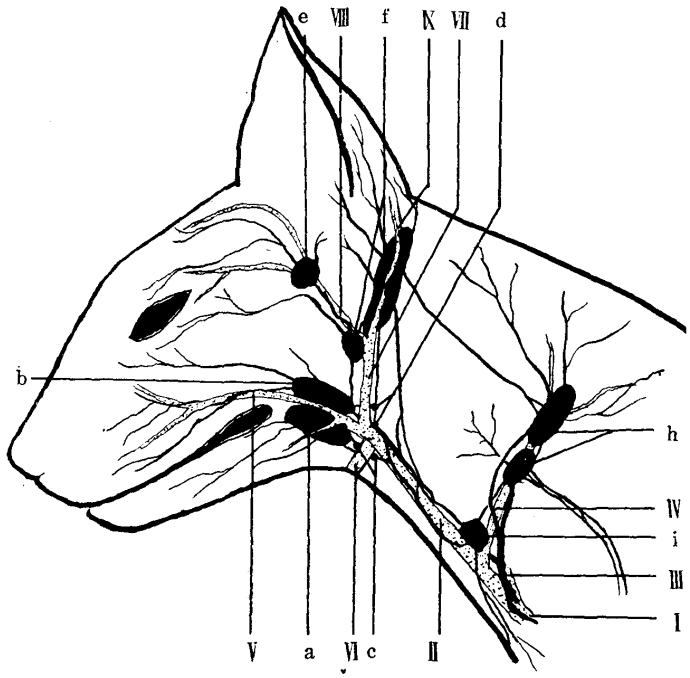

FIG. 2. *Profund Lymphonodi, Lymphatic Vessels (Black Line) and Veins (Stipple) Accompanied with Lymphatic Vessels Shown Diagrammatically*