

Case report of congenital goitre in a goat kid: Clinical and pathological findings

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Abstract

Congenital goitre is a deadly thyroid metabolic disorder characterised by low thyroid hormone levels, subsequent secretion of excess Thyroid-Stimulating Hormone (TSH) from the pituitary gland, and compensatory thyroid gland hyperplasia. This study aimed to summarise the clinical and pathological features of congenital goitre in a goat kid. In April 2019, a dead female goat kid with a history of dystocia was referred to Ferdowsi University of Mashhad Veterinary Teaching Hospital, Mashhad, Iran, to examine the carcass and find the reason for death. The necropsy were performed, along with histopathology examination, and clinical signs were recorded. Examination of the foetus revealed the presence of an enlarged thyroid gland, and the skin was thick with myxedema, pale, and without hair. After cutting the skin, the swelling showed a significantly enlarged thyroid gland with two asymmetrical lobes, with the right lobe 3.9×7.1 cm and the left 3.7×7.5 cm in size. In the histopathological examination, a severe proliferation of follicular cells was observed, which caused the thyroid gland to be microscopically dense. In conclusion, this study highlights the importance of recognising and addressing congenital goitre in goat kids. To prevent such tragic outcomes, it is crucial to focus on early detection and intervention. Furthermore, the agents of goitre need to find out and be clear.

KEYWORDS

congenital goitre, goat, iodine deficiency, thyroid gland

1 | INTRODUCTION

The essential endocrine gland for metabolic regulation is the thyroid (Barrea et al., 2021). The thyroid hormones triiodothyronine (T3) and thyroxin (T4) are critical for the functioning, growth, and metabolism of almost every body cell (Bhardwaj, 2018). The thyroid hormone synthesis is notable among the endocrine glands since the final assemblage occurs outside the cell in the follicular lumen. Thyroglobulin, a heavy glycoprotein, is synthesised in subsequent units on the ribosomes of the endoplasmic reticulum within the follicular cell (Loukopoulos et al., 2015). Iodine, a vital element, synthesises thyroid

hormone that controls energy regulation and carbohydrate, lipid and nitrogen metabolism (Yao et al., 2016). Metabolic demands and hormonal changes during pregnancy result in significant changes in the biochemical factors of thyroid function (Valavi et al., 2022). Noninflammatory and nonneoplastic growth of the thyroid gland, typically known as goitre, can evolve in all domestic birds, mammals, and other submammalian vertebrates (Hassan et al., 2013). Lambs and kids born with goitre are commonly detectable after birth. Because of impaired thermoregulation, decreased secretion of surfactants, decreased cardiac output, and arrhythmias, this condition affects the survival rate of lambs and kids. It is possible to find iodine deficiency in animals along

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with vitamin A deficiency and selenium deficiency. In addition to an iodine-deficient mother, dystocia, myxedema and a prolonged gestation may occur as a result of the foetus' iodine deficiency. This condition is economically significant because it usually results in the death of the foetus and the doe.

Worldwide there are few studies of describing the goitre in goat kid (Davoodi et al., 2022; Kadum & Luaibi, 2017). For goats, dietary iodine concentrations are considered inadequate because goats need more iodine than other ruminants. Since goats are browsing breeds that prefer to eat leaves, twigs, vines and shrubs and consume less soil than other grazing animals, goats are considered indicator species of iodine deficiency. The present paper aimed to represent an unusual case of a highly enlarged thyroid gland in a goat kid.

2 | METHOD AND MATERIALS

2.1 | Study area

Mashhad County is located in Razavi Khorasan Province in northeastern Iran, and the case was coming from there. This region consists of an area of approximately 27,480 km² with a population of 2500,000. It is situated in the valley of the Kashaf River between the mountain ranges of Binalood and Hezar-masjed, near Afghanistan to the east, Turkmenistan to the north, and is located at 36.20° north latitude and 59.35° east longitude. It is estimated that the city receives a maximum amount of precipitation of just 250 mm per annum, some of which falls as snow on occasion.

3 | CASE HISTORY, CLINICAL OBSERVATIONS AND RESULTS

A dead female goat kid with a history of dystocia was referred to Ferdowsi University of Mashhad Veterinary Teaching Hospital, Mashhad, Iran, to examine the carcass and find the reason for death. A necropsy of the carcass was performed, and gross pathologic lesions were recorded. The foetus had significant swelling in the cranioventral part of the neck (Figure 1). After cutting the skin, examination of the foetus revealed the presence of an enlarged thyroid gland with two asymmetrical lobes, with the right lobe 3.9 × 7.1 cm and the left 3.7 × 7.5 cm in size (Figure 2). At cross sections, two thyroid gland lobes were solid (Figure 3) and the skin was thick with myxedema, pale and without hair. In order to study the microscopic appearance of the lesions, tissue samples were taken from them and fixed in 10% buffered formalin, prepared using the usual method of paraffin embedding, and stained with haematoxylin and eosin. In the histopathological examination, severe proliferation of follicular cells was seen, which caused the thyroid gland to be observed microscopically solid (Figure 4). At some microscopic sections, the follicles were covered with several layers of follicular cells or split-shaped follicles were observed. The current study's histopathological report identified the colloid goitre.



FIGURE 1 Two enlarged thyroid lobes (asterisks) in the ventral part of the neck.

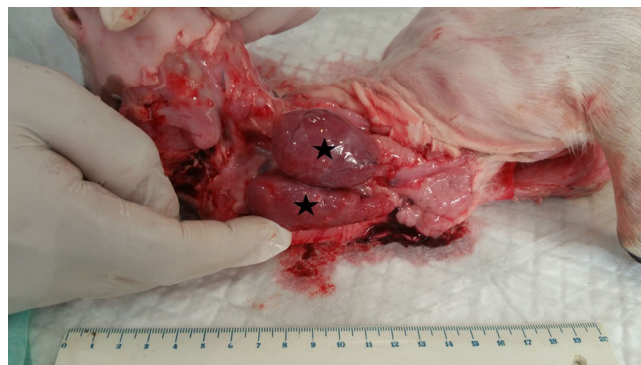


FIGURE 2 Two asymmetrical lobes of the enlarged thyroid gland (asterisks) were observed.



FIGURE 3 Note solid thyroid gland lobes at cross-section.

4 | DISCUSSION

As a result of goitre, the thyroid gland will enlarge and hyperplasia will occur. When the body lacks iodine, it causes the pituitary to overproduce thyroid-stimulating hormone (TSH), causing the thyroid to compensate by producing thyroid hormones to compensate for the deficiency (Zimmermann, 2020). Different animals have different symptoms of congenital goitre, depending on the primary defect (Singh & Beigh, 2013). The major reasons for developing thyroid hyperplasia are goitrogenic compounds and plants, iodine-deficient diets,

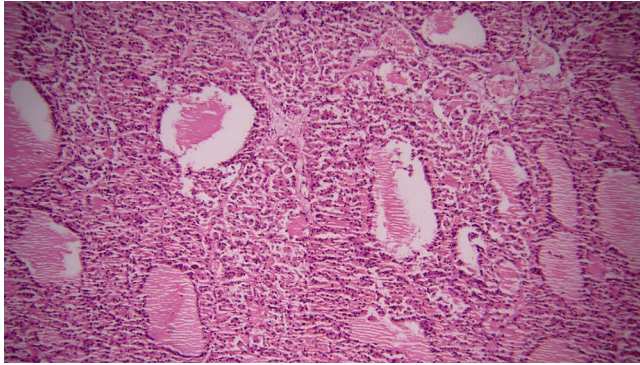


FIGURE 4 Severe proliferation of follicular cells and solid thyroid gland appearance with less follicles (haematoxylin and eosin, $\times 10$).

dietary iodine excess, and genetic enzyme defects in the biosynthesis of thyroid hormones (Agrawal et al., 2015). Retardation of foetal development and dead or weak neonates with goitre are adverse effects of iodine deficiency during pregnancy (Zimmermann, 2020). Enlarged thyroid glands in newborns suggest iodine deficiency, especially in those with high mortalities (Wassner & Brown, 2015). In order to diagnose the presence of an iodine deficiency in a herd, several methods have been utilised. These methods include monitoring thyroid weight, thyroid to body weight ratio in newborns, histological review of the glands, and measuring the level of thyroid hormones in serum (Knowles & Grace, 2007). One of the limitations of this study was the lack of access to maternal T3 and T4 measurements.

Similar to previous studies, hypertrophic thyroid glands were found in a kid in the present study (Bhardwaj, 2018; Singh et al., 2002). A frequent type of congenital goitre is hyperplastic, in which there is an excessive expansion of thyroid secretory epithelium with the shape of solid clusters and slit-like follicles, with the formation of villi and papillary into the follicular lumen (Jamshidi, 2022). The current study's histopathological report identified the colloid goitre as reported by a similar study, which has been described as the revolutionary step of diffuse hyperplastic goitre in young animals (Reddy et al., 2016).

In addition to the limitations of this study, no measurements of iodine levels in soil or alfalfa hay were conducted. Mountainous regions, low-height regions far from the sea, and areas with low soil iodine levels can result in iodine deficiency (Nyström et al., 2016). A lack of iodine can be caused by a variety of environmental factors, including seasonal changes and rainfall that leaches the mineral out of the soil (Zicker & Schoenherr, 2012). There is a recommendation to supplement ruminant flocks with iodine during heavy rainy seasons because it is possible to have iodine deficiency in these areas. In goats, iodine deficiency is mostly visible due to their selective eating and low soil consumption (Lovreglio et al., 2014). Compared to other ruminants, goats require a higher intake of iodine. It is recommended that goats consume an iodine range of 0.5–0.8 mg/kg of DM from the diet, even though there is not enough data available (Nudda et al., 2009).

An evaluation of goitre in goats was conducted by Davoodi et al. (2022) in the Darreh Garm region near Khorramabad city (Davoodi

et al., 2022). As part of their study, the researchers reported three goats with congenital enlargements of the thyroid glands and examined them clinically, radiographically and sonographically. Thyroid hormone levels were measured in blood samples taken from does and kids. Iodine concentrations were also measured in soil and forage. With sodium thyroxine treatment, thyroid hormone levels in affected does and kids increased. According to the soil and pasture reports, iodine levels were below average in the soil and pasture, suggesting that goats should receive dietary iodine supplements at the level of 0.5 mg/kg in order to prevent iodine deficiency.

5 | CONCLUSION

Based on the clinical, gross and histopathological findings of the current study, the pathological condition was identified as colloid goitre. Iodine is recommended to be added to the diet meal of goats that live in regions with low iodine levels in the forage and diet to prevent congenital goitre in these animals.

AUTHOR CONTRIBUTIONS

Conceptualisation: Hossein Nourani. Methodology: Hossein Nourani and Soheil Sadr. Formal analysis and investigation: Hossein Nourani and Soheil Sadr. Writing – original draft preparation: Hossein Nourani and Soheil Sadr. Writing – review and editing: Hossein Nourani and Soheil Sadr. Supervision: Hossein Nourani.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

FUNDING INFORMATION

No funding was received for conducting this study.

DATA AVAILABILITY STATEMENT

The data sets generated during and/or analysed during the current study are available from the corresponding author upon reasonable request.

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PEER REVIEW

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ETHICS STATEMENT

All applicable international, national, and/or institutional guidelines for the care and use of animals were followed. The Ferdowsi University of Mashhad Veterinary Faculty Ethics Committee has approved this study.

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