

Fetal Study Of Cardiac Mucosa At Gastroesophageal Junction

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Abstract

Traditionally, cardiac mucosa has been considered one of the three mucosal types normally found in the stomach. It has surface columnar lining and deep mucus secreting cardiac glands. It can be subcategorized as oxynto cardiac if cardiac gland also contains some parietal cells. Traditionally, cardiac mucosa is considered as normal congenital lining, but challenged by some researcher as metaplastic lesion.

Objective :

To describe the histological features at gastroesophageal junction for the presence of cardiac mucosa

Material And Method :

After taking due permission from Research Ethics Board, RIMS Imphal , 60 fetuses of 15 to 35 wks were collected from the department of Obstetrics and Gynaecology and processed for the study. Full thickness sections across gastroesophageal junction were prepared. 5 to 6 μ m thick alternate sections were stained with Hematoxylin and eosin, and Masson's trichome stains. Microscopic analysis were done under Trinocular Research compound microscope.

Results :

Cardiac mucosa starts appearing first at 15 weeks of gestational age. Few scattered parietal cells were also present. Cardiac gland present at 15 weeks was tubular in form, which persisted up to 24th wks. Tubular form later changed into tubulo acinar form from 25 weeks of gestational age . Amount of parietal cells present scattered increased with increasing gestational age. Pit formation was observed between 21-25 weeks of gestation.

Conclusion :

The present study shows that cardiac mucosa is a normal histological structure, which consists of pure mucous secreting gland with dispersed parietal cells.

Keywords: cardiac mucosa, squamocolumnar junction, gastroesophageal junction.

Introduction

Cardiac mucosa, comprising a surface epithelial compartment of mucus-producing foveolar cells and a deeper epithelial compartment composed of mucous glands or mixed mucous / oxyntic glands, is found frequently at the squamocolumnar junction (SCJ) where the esophagus joins the stomach.¹

The Cleveland Clinic group defined the cardiac mucosa as “the mucosa composed of unequivocal PAS –positive mucous glands arranged in lobular formation”. Whereas, the University of Southern California defined it as “the mucosa composed of glands with mucous cells only.”²

Recent histopathological studies have characterized the morphologic features of the mucosal gastroesophageal junction (GEJ) and defined the

following histological features of the mucosal GEJ as the distal ends of esophageal

1. squamous mucosa or island
2. deep esophageal glands and ducts
3. multilayered epithelium and hybrid glands and
4. double-layered muscularis mucosa.

Squamous mucosa and deep esophageal glands and ducts are unique to the esophagus and absent in the stomach. Therefore, these histologic landmarks are currently the gold standard of the esophagus and used to histologically define the mucosal GEJ.³

Cardiac mucosa traditionally was assumed to be the normal, congenital lining of the gastric cardia but, in 1997, Chandrasoma proposed cardiac mucosa as an acquired, gastroesophageal reflux disease (GERD)-induced metaplasia of the esophagus⁴.

Histology studies attempting to resolve the issue of whether cardiac mucosa at the SCJ is normal or metaplastic have been limited by the use of: (i) superficial pinch biopsies from patients in endoscopy units who cannot be considered normal subjects, (ii) abnormal esophagi resected typically because of cancer, or (iii) autopsy specimens in which tissue autolysis in the stomach can severely obscure histologic findings at the GEJ.⁵

In the present study, we described the histogenesis of GEJ in fetuses of different gestational ages to clarify if cardiac mucosa is a normal structure.

Materials And Methods

A cross sectional study was performed at the Anatomy department, Regional institute of medical sciences, Imphal from December 2020 to September 2022.

Data Collection :

After taking due permission from the Research Ethics Board, RIMS Hospital and informed consent from the concerned parent, fetuses of terminated pregnancies under MTP act of India, 1971 and still

birth ages ranging from 13 weeks to 40 weeks, were collected from the department of obstetrics and gynaecology, RIMS, Imphal. Full confidentiality of the individual was maintained. Data were recorded in predesigned proforma. Fetuses with gross congenital anomaly were excluded.

Full thickness sections across gastroesophageal junction were prepared. 5 to 6 μ m thick alternate sections were stained with Hematoxylin and eosin, and Masson's trichrome stains. Microscopic analysis were done under Trinocular Research compound microscope.

Results

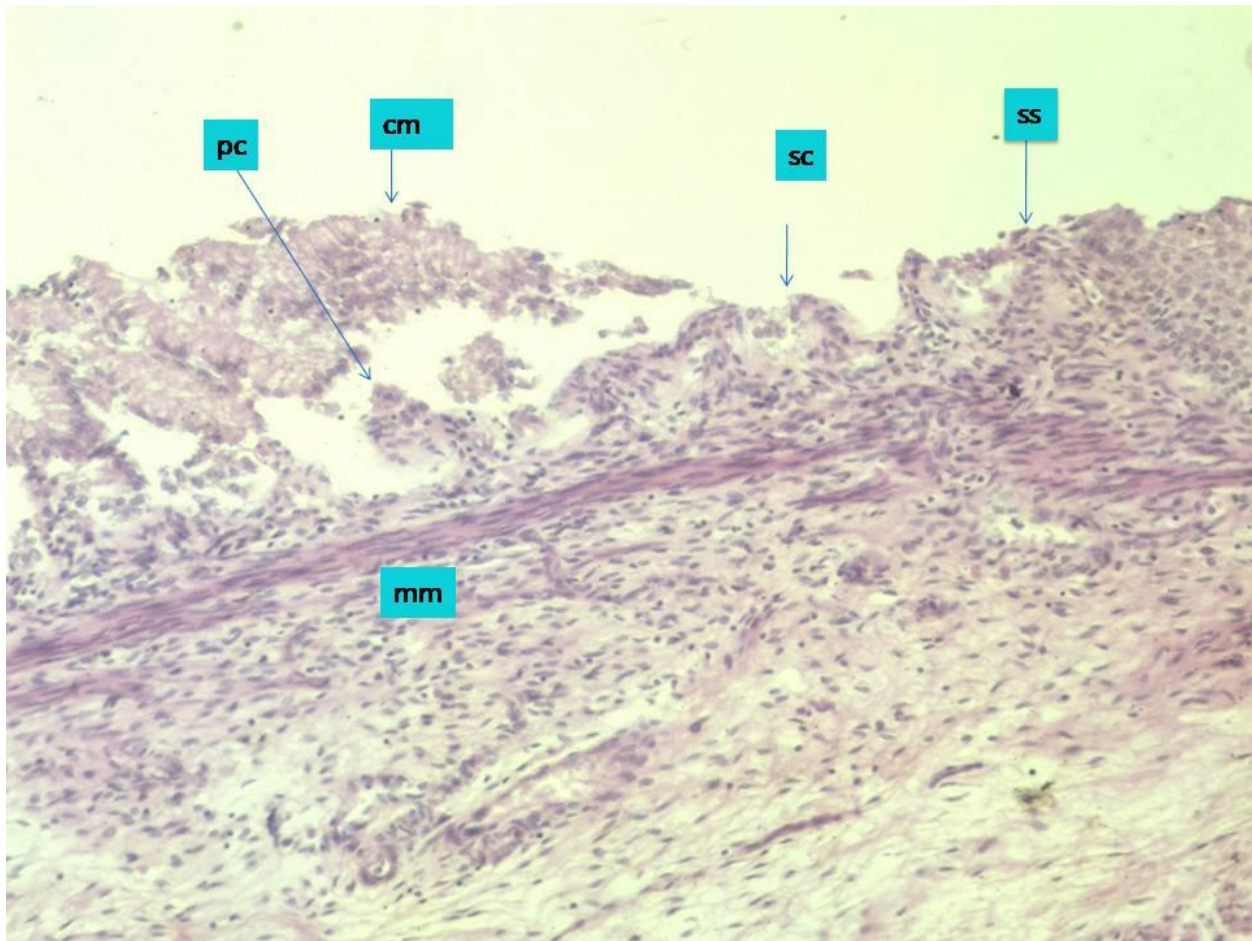
A total of 60 fetuses who met the inclusion criteria were used in the study, out of which 25 (41.67%) were male and 35(58.33%) were female. Fetuses were classified into six groups. In first group 13-15 weeks, 4 fetuses (7%) were studied (2 male and 2 female). In second group 16-20 weeks, 11 fetuses (18%) were studied (3 male and 8 female). In third group 21-25 weeks, 24 fetuses (40%) were studied (10 male and 14 female). In fourth group 26-30 weeks, 5 fetuses (9%) were studied (2 male and 3 female). In fifth group 31-35 weeks, 14 fetuses (23%) were studied (8 male and 6 female). In last group 36 - 40 weeks, 2 female fetuses (3%) were studied.

GROUP I (13-15WEEKS)

Cardiac mucosa consisting of mucus secreting simple columnar epithelium and deep cardiac gland started appearing at 13 weeks of gestation (which is the earliest fetus in the present study) as shown in Figure 1. Cardiac gland was tubular in form. Few scattered parietal cells were present in the mucus secreting gland towards the gastric side.

Transitional epithelium, present between columnar epithelium of cardiac mucosa and stratified squamous epithelium of esophagus, was composed of stratified cuboidal epithelium as shown in Figure 1.

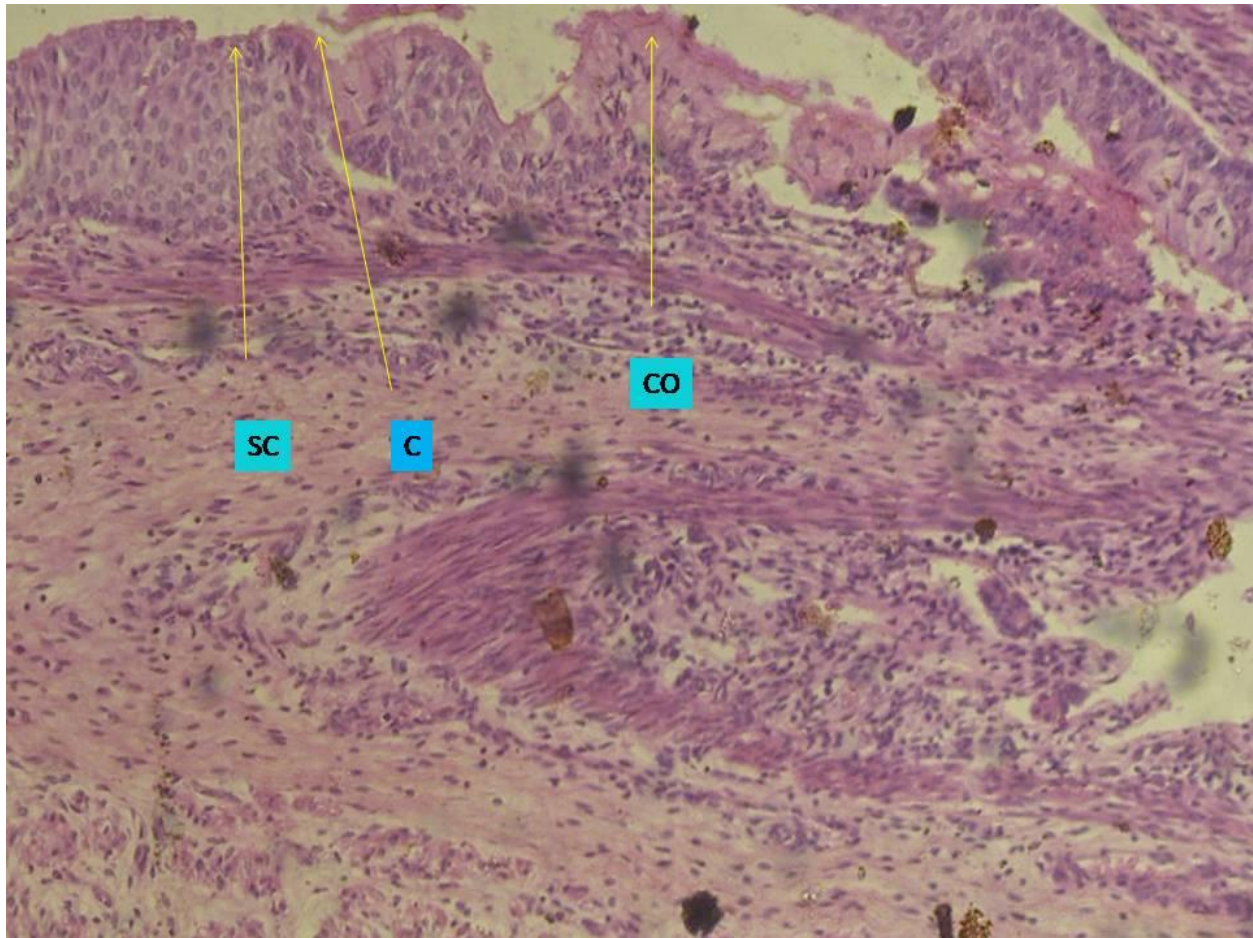
Fig 1 showing cardiac mucosa (cm) lined by simple columnar epithelium with scattered parietal cell (pc). Muscularis mucosa(mm) is also visible. Transitional epithelium composed of stratified columnar (sc) is also visible between cardiac mucosa and stratified squamous epithelium (ss) of esophagus.



GROUP II (16-20WEEKS)

Cardiac mucosa consisting of simple columnar epithelium was present along with deep mucus secreting cardiac gland. Scattered parietal cells present among the mucus secreting cardiac gland increased in number in a particular field view compared to the first group. Transitional zone were present between columnar epithelial lining of cardiac mucosa and stratified squamous lining which consisted of stratified cuboidal with patches of ciliated epithelium layer as shown in Fig 2.

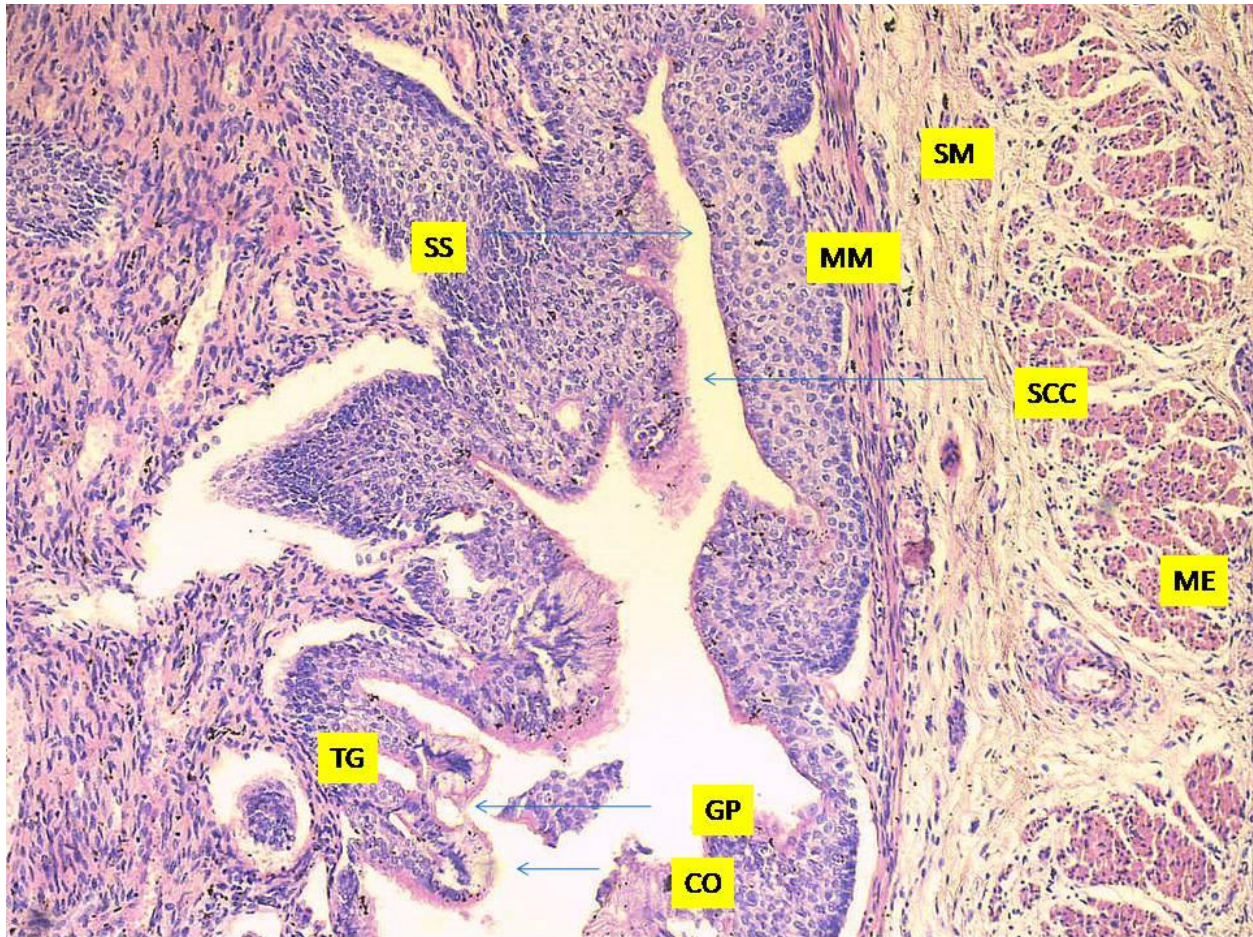
Fig 2 shows stratified columnar (sc) lining with patches of cilia (C). Columnar epithelium(CO) of cardiac mucosa is also visible with parietal cell at base



GROUP III (21-25 WEEKS)

Cardiac mucosa consisting of simple columnar cell were present with tubular mucus secreting gland along with parietal cell at base of the gland as shown in Fig 3. Gastric pit formation was observed from 22 weeks of gestation.

Fig 3 shows gastric pit (GP) along with tubular cardia gland(TG). CO represents columnar epithelium of cardiac gland. Stratified ciliated columnar (SCC) were present between stratified squamous (SS) and columnar epithelium(CO). MM represents muscularis mucosa, SM represents sub mucosal layer and ME represents muscular externa.

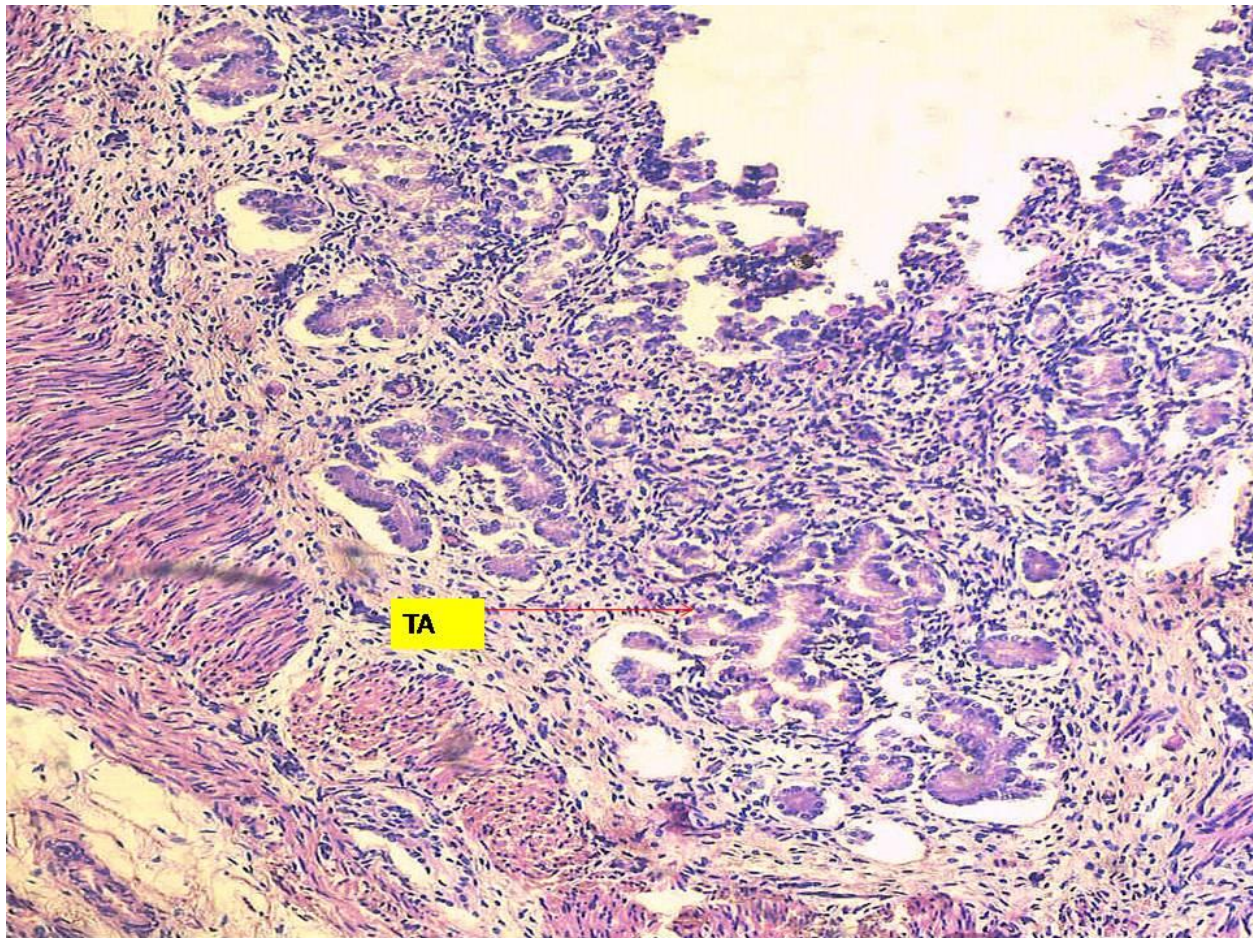


GROUP IV (26-30 WEEKS)

Cardiac mucosa were lined by simple columnar epithelium. Tubular form of mucus secreting cardiac gland changed into tubulo acinar form of mucus secreting gland as shown in Fig 4. Parietal cell became more prominent. Gastric pit started coming more towards the esophageal side.

Fig 4 shows tubuloacinar form of cardiac gland (TA).

In the last two groups between 31-35 weeks and 36-40 weeks, no significant changes were observed. All the findings present in the earlier groups were still presented.



Discussion

The question of cardiac mucosa being a normal constituent of gastrointestinal tract or acquired structure due to metaplasia is very important from a clinical view point. If cardiac mucosa arises due to metaplasia, the finding of such a mucosa in a biopsy specimen from the GEJ region may indicate the first step in a sequence of gastroesophageal reflux disease to adenocarcinoma as suggested by Chandrasoma⁴.

If cardiac mucosa develops during pregnancy, it is a normal structure at birth. In the present study, histology of GEJ of fetuses were studied to clarify whether cardiac mucosa is congenital or acquired due to metaplasia.

The findings of Zhou et al⁶, Kilgore et al⁷, Glickman et al⁸, Hertogh et al¹⁰ of cardiac mucosa at GEJ is in

conformity with the findings of the present study. The cardiac mucosa in the study of Zhou et al⁶, Glickman et al⁸, Hertogh et al¹⁰ composed of mixed glands containing mucous cells with isolated parietal cells, which matched with the finding of present study.

The cardiac mucosa in the study of Kilgore et al⁷ composed of pure mucous cell only, which differ from the present study.

The finding of Park et al⁹ of cardiac mucosa without any glandular elements differed from the present study, where the glandular elements composed of pure mucous secreting cells with scattered parietal cells were present

Cardiac mucosa consisting of columnar epithelium lining and deeper glandular zone, universally present

between squamous epithelium and oxyntic mucosa in the fetus and neonates.⁶

Cardiac mucosa, composed of pure cardiac mucosa on the gastric side of the esophageal squamous epithelium in patient without known history of gastroesophageal reflux disease or Barrett's esophagus were present, supporting the concept that the gastric cardia is present from birth as a normal structure.⁷

Columnar epithelium comprised exclusively of cardia type epithelium (mucous glands only) at the GEJ within 1 mm of squamo columnar junction of pediatric patients of all ages, suggested at least a small amount of gastric cardia is congenital in origin.⁸

Transitional zone present between squamous epithelium and oxyntic mucosa were composed of foveolar epithelium without glandular portion in fetuses studied. In the postnatal cases, the transitional zone contains glandular structures composed of both parietal cells and mucosal cells.⁹

Cardiac mucosa was present at a gestational age of 13 weeks, the youngest fetus in the study. Cardiac mucosa was also observed in all the specimens examined.¹⁰

Adult study of Stojacic *et al*¹¹ and Odze *et al*⁵ also observed the presence of cardiac mucosa composed of both pure mucous and oxynto cardiac glands.

The study of Chandrasoma *et al*^{12,13}, Serbia *et al*¹⁴, Lenglinger *et al*¹⁵, Kim *et al*¹⁶ in adult specimen supported the opinion that cardiac mucosa developed following gastroesophageal reflux (GERD) and esophagitis / carditis.

Oxyntocardiac mucosa, in which glands contain a mixture of mucous and parietal cell was present only in part of circumference of the junction. There was a tendency for the presence and extent of cardiac mucosa to increase with age, which lead to the hypothesis that cardiac mucosa represented an early manifestation of gastroesophageal reflux.¹²

Cardiac mucosa (CM) or oxyntocardiac mucosa (OCM) was present in 68 of 71 patients. Patients with a CM+OCM length >2cm had a markedly higher acid exposure than patients with a CM+OCM length <2cm. The findings suggested that the presence of CM and OCM in the junctional region are predictive of

abnormal acid exposure and hence histologic findings of CM and OCM represents a sensitive histologic criterion for gastroesophageal reflux rather than normal epithelium.¹³

The following adult autopsy studies also suggested cardiac mucosa or oxyntocardiac mucosa to be a dynamic structure, that probably reflects the influence of underlying GERD.^{14,15}

Kim *et al*¹⁶ concluded that CM at the gastroesophageal junction is a common histologic finding in biopsy specimens, and associated with gastroesophageal reflux disease and carditis severity.

All the above studies were adult autopsy study and they supported the presence of cardiac mucosa following GERD / carditis.^{12,13,14,15,16}. As the present study is fetal study, comparison were not made.

In conclusion, we observed cardiac mucosa in all the specimen studied starting from 13 weeks of gestation. The present study shows that cardiac mucosa is a normal histological structure, which consists of pure mucous secreting gland with dispersed parietal cells.

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