Fallopian canal dehiscence: can it be predicted

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Abstract The aim of the study is to give an idea about true incidence and most common location of fallopian canal dehiscence and to identify predictive factors associated with fallopian canal dehiscence based on preoperative and per-operative clinical correlates so as to facilitate preemptive prediction of the condition. The study design pertains to a prospective study. The setting of the study was tertiary referral hospital and a total of 146 patients underwent radical and modified radical mastoidectomy as primary procedure between Jan. 2003 to Dec. 2004. The site of dehiscence and associated pre-operative and per-operative findings were noted. Our results showed the incidence of fallopian canal dehiscence among cases undergoing radical and modified radical mastoidectomy was 82/1000 per year. Around 66.6% dehiscence was located in tympanic segment. The preoperative factors significantly associated with the fallopian canal dehiscence ($p < 0.05$) were Aural polyp, Extra-cranial complications, Cholesteatoma and Facial palsy. Per-operative findings were Cholesteatoma, All ossicles necrosed except stapes footplate and Lateral semicircular canal fistula.

Keywords Fallopian Canal Dehiscence · Incidence · Predictive factors · Pre-operative · Per-operative

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Introduction

Fallopian canal dehiscence is a common but important condition associated with chronic CSOM. It can either be congenital or acquired. Congenital fallopian canal dehiscence is a developmental defect in the bony covering of facial nerve and is most commonly encountered in the tympanic segment (60%) [1, 2]. Acquired cases are most commonly associated with atticointral type of CSOM with underlying cholesteatoma [3, 4]. Although the surgery for chronic disease is a common practice, lack of literature asserting true incidence of acquired fallopian canal dehiscence and absence of guidelines to assist in preoperative prediction of these condition leads to many cases of inadvertent injury to the facial nerve and subsequent morbidity. Only investigation to confirm the presence of dehiscence is high resolution CT, which is still a costly modality in the setting of developing country [5]. The aim of the study is to give an idea about true incidence and most common location of acquired fallopian canal dehiscence and to identify predictive factors associated with fallopian canal dehiscence based on preoperative and per-operative clinical correlates so as to facilitate preemptive prediction of fallopian canal dehiscence.

Materials and methods

The study was carried out in a tertiary referral hospital of a developing country. It comprises of prospective analysis of 146 cases that underwent radical and modified radical mastoidectomy for chronic CSOM selected on the basis of presenting complaints and clinical findings during 2 year period between Jan 2003 to Dec 2004. Data collection entails maintaining complete data related to history, pre-operative findings at the time of presentation, per-operative findings and results of follow up for all the cases selected for the study. Apart from noting the age and sex of the

patients, Pre-operative findings were assorted under 9 different variables decided upon before the initiation of the study i.e. Atelectasis, Extracranial complications, Posterior-superior granulations, Aural polyp, Cholesteatoma, Intra-cranial complications, Edematous middle ear mucosa, Facial palsy and Post-aural fistula. The per-operative findings were noted under 6 variables i.e. Cholesteatoma, Granulation, All ossicles necrosed except stapes footplate, erosion of sigmoid plate and dural plate, Lateral semicircular canal fistula. To maintain the uniformity of the data collection, all pre-operative examination and operations were done by two surgeons. The patients were divided into two groups i.e. those with fallopian canal dehiscence and those without fallopian canal dehiscence. The data comprising of pre-operative variables and per-operative variables were compared between these two groups with the group consisting of no fallopian canal dehiscence acting as a control.

As the fallopian canal dehiscence can either be congenital or acquired and no diagnostic test could differentiate between the two in a patient presenting with CSOM, all cases in which fallopian canal dehiscence was noted during surgery were presumed to be due to acquired cause. The working definition of fallopian canal dehiscence used for the study was the complete lack of bony covering over the facial nerve in any part of the trans-temporal course of the facial nerve.

All patients were subjected to common battery of tests that included routine blood tests, X-ray mastoid lateral oblique view, pure tone audiometry and tympanometry and examination under microscope and CT scan of temporal bone in selected cases.

The Statistical package for social sciences (SPSS), 10.0 windows compatible programme was used for statistical analysis. When evaluating the data from the study, bivariate analysis was done and odd's ratio for respective preoperative and preoperative variables along with its 95% confidence interval was calculated. The results were evaluated with respect to 95% confidence level and $p < 0.05$ significance levels to give the pre-operative and per-operative variables significantly associated with acquired fallopian canal dehiscence.

The patients were followed-up at intervals ranging between 3 months to 1 year.

Results and analysis

A total of 146 patients who underwent radical and modified radical Mastoidectomy as primary procedure in our hospital between Jan 2003 to Dec 2004 were included in our study. The mean age of patient was 22.25 years (Range: 9–50; SD: 7.033). There were 60 females (41.1%) [Dehiscent group: 10(16.7%); Non-dehiscent group: 50 (83.3%)], 86 males (58.9%) [Dehiscent group 18(20.9%); Non-dehiscent group 68(79.1%)].

Out of 146 cases, fallopian canal dehiscence was seen in 24 cases (16.4%) and no dehiscence was seen in 122 cases (83.6%). Out of the dehiscent cases, involvement of the horizontal part of facial nerve was seen in 16 cases (66.6%) and the vertical part in 8 cases (33.3%). (Table 1). In the horizontal part, most common site of dehiscence was the 2nd genu.

All the patients underwent primary surgery. Apart from noting the Age and Sex of the patients, Pre-operative findings were assorted under 9 different variables (Fig. 1). The per-operative findings were noted under 6 variables (Fig. 2). Odd's ratio for respective preoperative and per-operative variables along with its 95% confidence interval was calculated and the results were systematically tabulated.

The age of the patients in the study was divided into 3 categories in an attempt to find out the high-risk age group. The subcategories were subjected to bivariate analysis which gave the p value for all the subcategories to be greater than 0.1, this emphasizing that none of the age groups was significantly associated with the dehiscence. (Table 2). Data also revealed that sex of a patient is also not a significant predictor of fallopian canal dehiscence (Table 2).

Fig. 1 Preoperative findings in Dehiscent and Non-dehiscent groups

Fig. 2 Per-operative findings in Dehiscent and Non-dehiscent groups

Table 1 Incidence of fallopian canal dehiscence

Non-dehiscent cases	Dehiscent cases
122 (86.4%)	24 (16.4%)
	Horizontal
	16 (66.6%)
	Vertical
	8 (33.3%)

cranial complications as it was very common (dehiscent group: 4, non-dehiscent group: 10) as compared to the other extracranial complication hence warranting separate attention. Facial palsy with positive evidence of ear disease, to exclude the cases of Idiopathic Bell's palsy. The variables were subjected to bivariate analysis and odd's ratio for respective preoperative and per-operative variables along with its 95% confidence interval was calculated.

Table 2 Bi-variate analysis of preoperative variables

Pre-operative findings	Dehiscence n (%)		Odds ratio	Bi-variate analysis	p:
				95% CI	
Age categories (Years)	0–20	10/68 (19.1)	0.603	0.14–2.70	0.442
	21–30	10/60 (18.3)	0.70	0.16–3.14	0.590
	≥31	4/18 (22.2)	1	–	–
Sex (M/F)	M	18/86 (20.9)	2.382	0.885–6.415	0.080
	F	6/60 (10.0)			
Atelectasis	Yes	4/42 (9.5)	0.442	0.141–1.382	0.152
	No	20/104 (19.2)	1		
Extracranial complications	Yes	6/18 (33.3)	3.056	1.018–9.174	0.039
	No	18/128 (14.1)	1		
Posterior superior granulation	Yes	1/17 (5.9)	0.288	0.036–2.283	0.212
	No	23/129 (17.8)	1		
Aural polyp	Yes	12/18 (66.7)	19.333	6.145–60.822	0.000
	No	12/128 (9.4)	1		
Cholesteatoma	Yes	5/11 (45.5)	5.088	1.412–18.338	0.007
	No	19/135 (14.1)	1		
Intracranial complications	Yes	0/0 (0)	–	–	–
	No	24/146 (16.43)	–		
Edematous middle ear mucosa	Yes	0/4 (0)	–	–	0.368
	No	24/142 (16.9)	–		
Facial palsy	Yes	4/6 (66.7)	12.0	2.060–69.900	0.001
	No	20/140 (14.3)	1		
Post-aural fistula	Yes	4/14 (28.6)	2.240	0.640–7.845	0.198
	No	20/132 (15.2)	1		

CI: Confidence interval

The Table 2 and Table 3 shows the association of the preoperative and per operative variables with the presence of dehiscence. The preoperative findings which were systematically evaluated were Atelectasis (all grades), Extra-cranial complications on presentation (Mastoid abscesses, Petrositis, Labyrinthitis), Posterosuperior granulation seen on clinical examination and examination under microscope, Aural poly, Cholesteatoma seen on clinical examination and examination under microscope, Intracranial complications (Brain abscess, Extradural abscess, Subdural abscess, Sigmoid sinus thrombosis, Meningitis). Postaural fistula was not included in the extra

The variables which were found significant on bivariate analysis ($p < 0.05$) were Extracranial complications ($p = 0.039$), Aural polyp ($p = 0.000$), Cholesteatoma ($p = 0.007$) and facial palsy ($p = 0.001$) among the preoperative findings and Cholesteatoma ($p = 0.03$), All ossicles necrosed except stapes footplate ($p = 0.009$) and Lateral semicircular canal fistula ($p = 0.000$) among the per-operative findings. The p value of the Aural polyp and Lateral semicircular canal fistula was in the range of infinity so was beyond full calculation so the p value is not mentioned completely.

Table 3 Bi-variate analysis of per-operative variables

Per-operative findings		Dehiscence n (%)	Bivariate analysis		
			Odd's ratio	95% CI	p:
Cholesteatoma	Yes	18/80 (22.5)	2.903	1.079–7.811	0.030
	No	6/66 (9.1)	1		
Granulation	Yes	8/62 (12.9)	0.630	0.259–1.581	0.322
	No	16/84 (19.0)	1		
All ossicles necrosed except stapes footplate	Yes	16/62 (25.8)	3.304	1.311–8.327	0.009
	No	8/84 (9.5)	1		
Erosion of sigmoid plate and dural plate	Yes	2/28 (7.1)	0.336	0.074–1.521	0.140
	No	22/118 (18.6)	1		
Lateral semicircular canal fistula	Yes	6/10 (60.0)	9.833	2.527–38.270	0.000
	No	18/136 (13.2)	1		

CI: Confidence interval

Discussion

Fallopian canal dehiscence is an uncommon but important condition associated with atticointral variety of CSOM. Although the surgery for atticointral disease is a common practice, lack of literature asserting true incidence of acquired fallopian canal dehiscence and absence of guidelines to assist in preoperative prediction of this condition leads to many cases of inadvertent injury to the facial nerve and subsequent morbidity. The lack of literature concerning the conditions associated with fallopian canal dehiscence further amplifies the problem.

Fallopian canal dehiscence can be congenital or acquired. Congenital fallopian canal dehiscence is a developmental defect in the bony covering of facial nerve and is most commonly encountered in the tympanic segment (60%) [1, 2]. Acquired cases are most commonly associated with atticointral type of CSOM with underlying cholesteatoma. The incidence of fallopian canal dehiscence at surgery for middle ear cholesteatoma has been reported to be around 33.3% during initial procedure and even higher during revision surgery (37.5%) [3, 4]. The incidence of fallopian canal dehiscence in our study, among cases undergoing radical and modified radical mastoidectomy for atticointral disease was 82/1000/year. The most common segment involved in dehiscence was the horizontal part of facial nerve (66.6%) as against the reported incidence of 87.2%. The vertical part was involved in 33.3% as compared to the previously reported incidence of 7.7% [5]. The most common site of dehiscence was the 2nd genu as suggested by other studies [3, 4] Although there is discrepancy in the rates between our study and earlier reports but the tympanic segment is still the most common segment involved in dehiscence which is also the most common injured area of facial nerve during otological procedure.

The study also attempts to correlates the dehiscence with some pre-operative and per-operative variables in an attempt to give some guiding principles to predict the underlying fallopian canal dehiscence which was conspicuously absent in the previous studies and thereby helping in avoiding potential injuries to facial nerve during surgery. A total of 9 preoperative variables were considered.(Table 2) Age and sex of the patient were evaluated separately. The age of the patients in the study was further categorized into 3 sub categories (= <20 years; 21–30 years; >30) so as to find out the age group most commonly associated with dehiscence. The subcategories were subjected to bivariate analysis which gave the p value for all the subcategories to be greater than 0.1, this emphasizing that none of the age groups was significantly associated with the dehiscence. Since the otological diseases are more common in children and young adults, it is often presumed that this age group will be most commonly associated with the dehiscence, but in reality, it is not the case and the condition can affects all age groups as evident from the study. Bivariate analysis of sex also showed that sex is not a significant predictor of the condition.

The preoperative factors significantly associated ($p < 0.05$) with the fallopian canal dehiscence were Extra-cranial complications, Aural polyp, Cholesteatoma and Facial palsy. Although Post-aural fistula appeared to be an important variable at the beginning of the study and hence was considered separately from other extra-cranial complications, but on bivariate analysis, it came out to be insignificant (Table 2). Aural polyps although traditionally thought to be associated with tubo-tympanic type of CSOM and representing a benign pathology, in our study it was seen to significantly associated with acquired fallopian canal dehiscence, which have been traditionally a feature of atticointral disease. Although no inference regarding

the causation of fallopian canal dehiscence could be drawn based on significant association, still the presence of aural polyp should make the surgeon more cognizant for the possibility of underlying fallopian canal dehiscence. The association of aural polyp with fallopian canal dehiscence may be explained from a long standing pathological process associated with genesis of aural polyp and association with osteitis and hyperemia which may be responsible for the erosion of fallopian canal. Cholesteatoma is generally responsible for the fallopian canal dehiscence [4, 5]. Granulation tissue although a common associated feature but seldom leads to bony erosion. Facial palsy in cases of chronic suppurative otitis media is either abrupt or gradual in onset. Abrupt onset palsy results from acute exacerbation superimposed on chronic infection whereas gradual onset typically results from the compression due to cholesteatoma. Pathologically, extrinsic compression of facial nerve do not lead to any dysfunction until 50% of nerve fibers are disrupted [5]. So the findings of fallopian canal dehiscence, cholesteatoma and facial palsy are all interrelated.

Per-operative findings which came out to be significant were Cholesteatoma, All ossicles necrosed except stapes footplate and Lateral semicircular canal fistula, all variables further suggesting long standing and severe disease (Table 3). Erosion of Sigmoid plates and Dural plate although appeared to be a serious condition however the study revealed them not be significantly associated.

To find out whether the model used for the study was truly useful, classification accuracy model was analyzed. It became obvious that before including the variables in the model the percentage of correct classification was 83.6% which increases significantly to 91.8% on running the variables using the model. Lack of further improvement might be attributed to the missing unknown variables which were not considered.

Conclusion

The incidence of acquired fallopian canal dehiscence among the cases undergoing radical and modified radical

mastoidectomy was 82/1000 per year, which was much higher than all other previous studies. This may be due to the fact that in our poor socioeconomic scenario, patients tend to present in an advanced stage where the pathological process has already eroded the fallopian canal thus explaining the higher incidence. The ratio of fallopian canal dehiscence in horizontal and vertical segment in our study was 2:1. Although incidence of dehiscence is known to be more common in horizontal part, a definitive ratio to compare with, was found to be surprisingly lacking in standard literatures. The most common area of dehiscence was at the 2nd genu which corroborates with other studies. The most important outcome of the study was significant association of preoperative presence of Aural polyp, Cholesteatoma, Facial palsy and Extra-cranial complications and per-operative presence of Cholesteatoma, All ossicles necrosed except stapes footplate and Lateral semicircular canal fistula with underlying fallopian canal dehiscence. Hence the presence of any of these variables, either alone or in any combination, preoperatively or per-operatively, should immensely help a novice otologist in suspecting an underlying dehiscence and thus preventing inadvertent facial nerve injury and subsequent morbidity.

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