

ORIGINAL RESEARCH

The Study of Anatomy of Accessory Pancreatic Duct and Its Variations

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ABSTRACT

Background: The duct system of pancreas consists of two large ducts – Main pancreatic duct and Accessory pancreatic duct. Both these ducts drain the entire exocrine part of pancreas. Main pancreatic duct is always present while accessory pancreatic duct may be absent in 30% cases. Presence of accessory pancreatic duct (probably patent) might protect the pancreas from the harmful consequences of obstruction of main pancreatic duct.

Material and methods: The present study is done in 50 adult formalin fixed pancreatic specimens removed during posterior abdominal wall dissection.

Results: The study showed 70% prevalence of accessory pancreatic duct. The accessory pancreatic duct coursed mainly through three major types- long type (20%), short type (45.72%) and ansa type (17.14%). Ducts which do not fall into the above said three patterns were included in a fourth group (17.14%). The mean length and standard deviation of the accessory pancreatic duct is 4.07 ± 1.07 cm and the mean width and standard deviation of the duct is 1.6 ± 0.6 mm. The openings of accessory pancreatic duct into major and minor duodenal papillae are 31.4% and 68.6% respectively.

Conclusion: The accessory pancreatic duct was observed only in one third specimens. Short type is the most common type of accessory pancreatic duct. The length of the duct varies from 3 to 5 cm and the width from 1 to 2.2mm. The accessory pancreatic duct mainly opens into minor duodenal papillae. A communication between accessory and main pancreatic duct is observed in 34.3%.

Keywords: Accessory pancreatic duct, prevalence, type, length, width, opening, communications.

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INTRODUCTION

The accessory pancreatic duct is the smaller and less constant pancreatic duct, but is the main drainage duct of the dorsal pancreatic bud in the embryo. The proximal part of the embryonic dorsal duct remained after the formation of main pancreatic duct is normally referred to as accessory pancreatic duct; also called 'duct of Santorini'. It may undergo further developmental changes after birth and finally becomes an accessory duct of drainage or may undergo fibrosis and disappears or is replaced by another duct. The knowledge of prevalence and type of accessory pancreatic duct helps in planning and estimation of prognosis in acute pancreatitis. The study of length and width of accessory pancreatic ducts is helpful in differentiating the congenital anomalies like dorsal and ventral partial agenesis of pancreas.

Ductal length is the main factor influencing the choice of surgical procedures like pancreatico_jujunostomy or pancreatic resection in chronic pancreatitis. The knowledge of pattern and termination of accessory pancreatic duct is important in cannulation of the minor duodenal papilla especially in pancreatic divisum and in distortion of main pancreatic duct.

MATERIALS & METHODS

The study is done in 50 adult formalin fixed specimens of pancreas and duodenum en-bloc obtained during dissection of posterior abdominal wall. The study is made regardless of age and sex. The duct system is approached from the posterior surface of the pancreas by piecemeal dissection of the substance of the gland. The main pancreatic duct is identified first and later the accessory pancreatic duct is identified in the head of the pancreas. The length of the ducts is measured using a thread and the vernier callipers. The width is directly measured using vernier callipers. A communication if present between the two ducts is identified. The duodenum is opened on the right side and the estimated entrance point for the accessory pancreatic duct into the duodenal lumen is made. The entire duct system is coloured using different paints and photographs of the patterns are taken.

RESULTS

The prevalence of the accessory pancreatic duct in the present study is tabulated in the [Table 1].

Table 1: Prevalence of the accessory pancreatic duct

Accessory pancreatic duct	Number of specimens	Percentage
Present	35/50	70%
Absent	15/50	30%

The accessory pancreatic duct may course along three different patterns in the head of the pancreas before its termination by opening into duodenum. The various patterns include long type, short type and ansa type. Ducts which do not fall into the above said three patterns were included in a fourth group.

The different courses of accessory pancreatic duct were defined as:

- A. Long-type: The accessory pancreatic duct forms a straight line and joins the main pancreatic duct at the neck portion of the pancreas. The long-type accessory pancreatic duct represents a continuation of the main duct of the dorsal pancreatic bud. Long type accessory ducts are more likely to have patent orifice at its duodenal end.
- B. Short-type: The accessory pancreatic duct joins the main pancreatic duct near its first inferior branch. The short-type accessory pancreatic duct is probably formed by the proximal main duct of the dorsal pancreatic bud and its long inferior branch and it has a longer length compared to long type. Short type ducts are less likely to have patent orifice.
- C. Ansa-type: Ansa variant of accessory pancreatic duct is described as an 's' shaped collateral duct between dorsal pancreatic duct and the inferior side branch of ventral duct.

The prevalence of these different types of accessory pancreatic duct is depicted in the following [Table 2].

Table 2: Various types of accessory pancreatic duct

Type of accessory pancreatic duct	No of specimens	Percentage
Long	7/35	20%
Short	16/35	45.72%
Ansa	6/35	17.14%
Others Horizontal	6/35	17.14%

The length of the accessory pancreatic duct is measured from its opening into the duodenum to its termination, either by uniting with main pancreatic duct or by a free ending in the lower part of head of the pancreas. Usually the long type will have a smaller length compared to the short and ansa types. The mean of the various lengths and its standard deviation is depicted in [Table 3].

Table 3: Mean length and standard deviation of the accessory pancreatic duct

Length of accessory pancreatic duct	Numerical value in cm
Mean average	4.07
Standard deviation	1.07

The [Table 4] shows mean length and standard deviation of accessory pancreatic duct based on their type:

Table 4: Mean length and standard deviation of the accessory pancreatic duct based on their type

Type of accessory pancreatic duct	Mean length	Standard deviation
Long	3.4	0.97
Short	5.0	1.05
Ansa	3.7	0.64
Others /Horizontal	4.2	0.98

The width of the accessory pancreatic duct is measured approximately in the middle of its entire length and its mean and standard deviation are calculated and depicted in [Table 5].

Table 5: Mean width and standard deviation of the accessory pancreatic duct

Width of accessory pancreatic duct in mm	
Mean average	1.6
Standard deviation	0.6

The [Table 6] shows the mean width and standard deviation of the accessory pancreatic duct based on their type:

Table no -6: Mean width and standard deviation of the accessory pancreatic duct based on their type

Type of accessory pancreatic duct	Mean width	Standard deviation
Long	1.6	0.55
Short	1.6	0.55
Ansa	1.5	0.35
Horizontal	1.8	0.49

The accessory pancreatic duct draining the upper part of anterior portion of the head of pancreas opens into minor duodenal papilla. Sometimes it may open into major duodenal papilla if there are any ductal fusion abnormalities during development. The number and percentage of ducts opening into major and minor papilla are given in [Table 7].

Table 7: Opening of the accessory pancreatic duct into major and minor duodenal papillae

Opening of accessory pancreatic duct into	Number	Percentage
Major duodenal papilla	11/35	31.4%
Minor duodenal papilla	24/35	68.6%

The accessory pancreatic duct drains its contents into main pancreatic duct through a small communication between the two ducts 1-2cm in length, which may or may not be present. The table-8 shows number and percentage of specimens with and without communication.

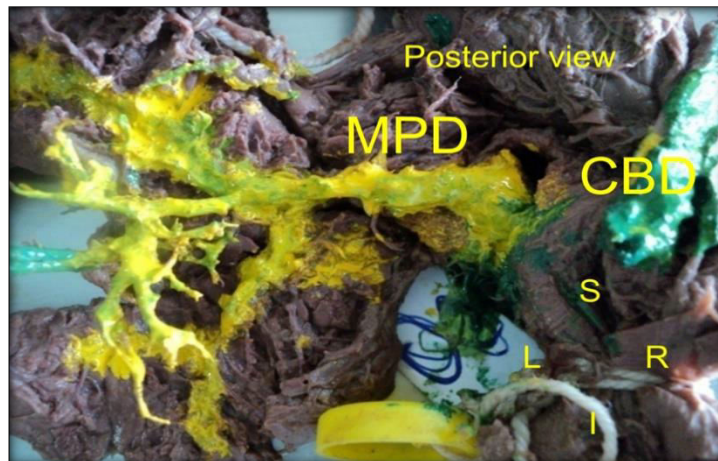


Figure 1: Photograph showing absence of accessory pancreatic duct (with extensive branching of main pancreatic duct in head)

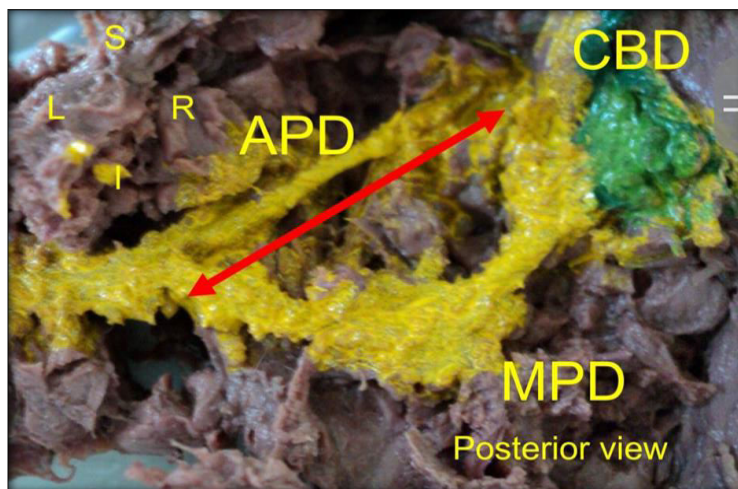


Figure 2: Photograph showing long type of accessory pancreatic duct

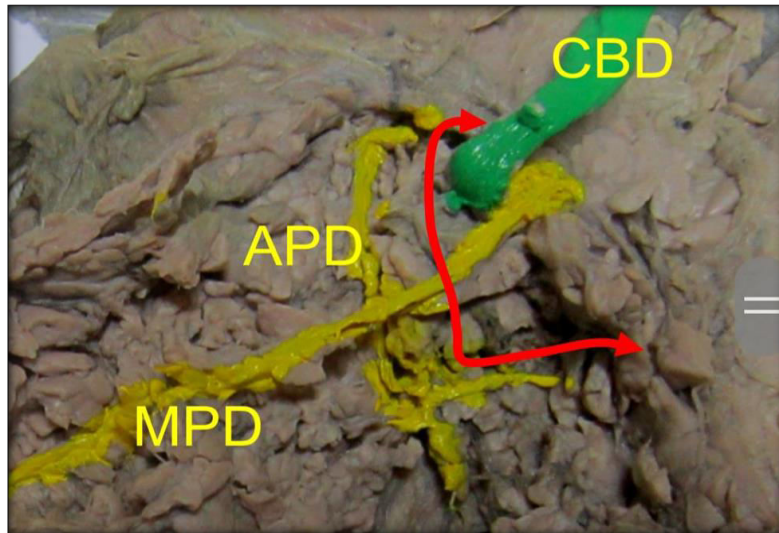


Figure 3: Photograph showing short type of accessory pancreatic duct

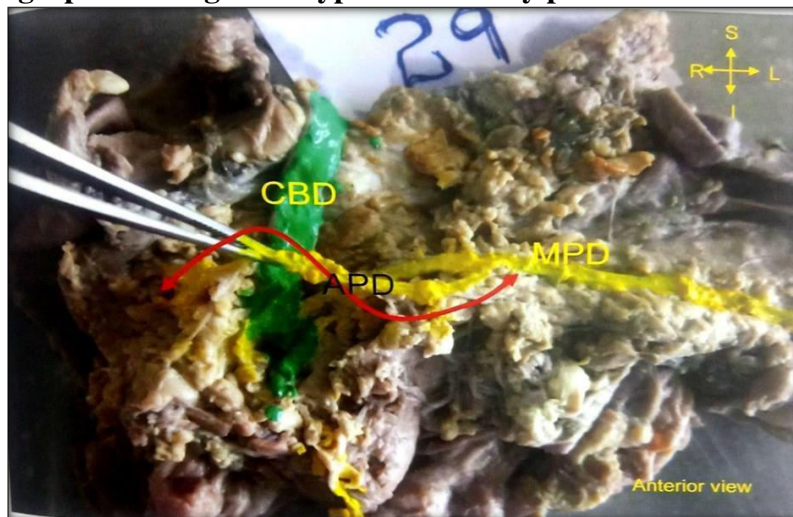


Figure 4: Photograph showing ansa type of accessory pancreatic duct (29)

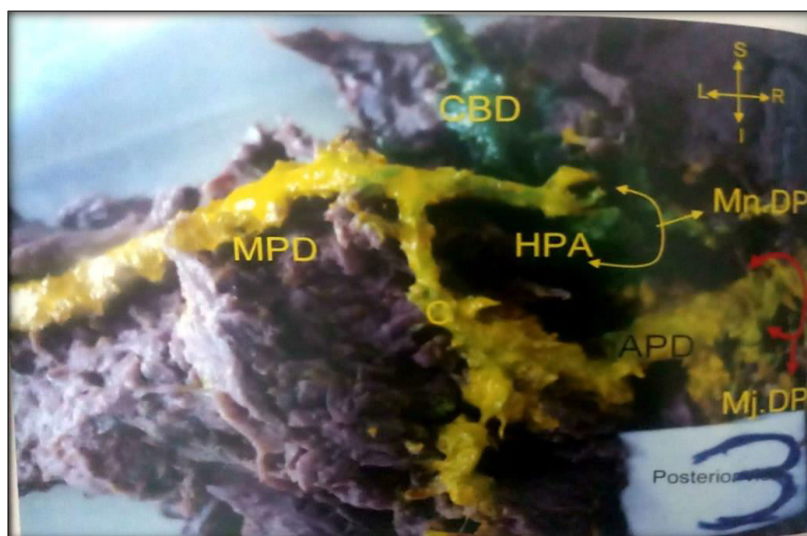


Figure 5: Photograph showing opening of accessory pancreatic duct into major duodenal papilla (3)

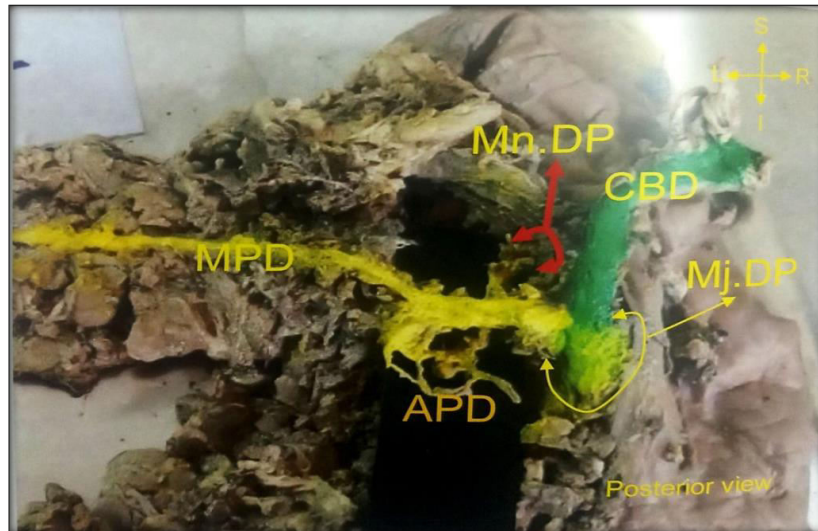


Figure 6: Photograph showing opening of accessory pancreatic duct into minor duodenal papilla

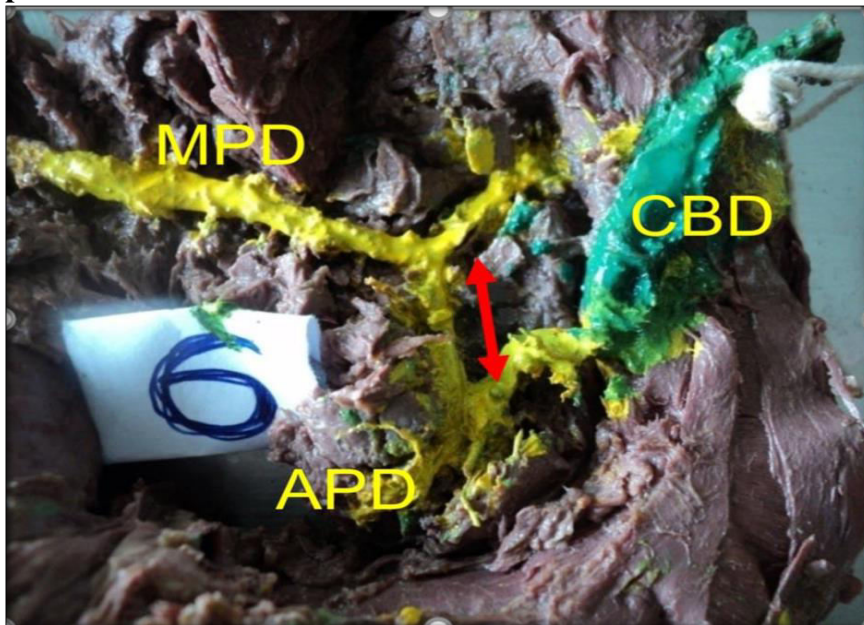


Figure 7: Photograph showing communication between main and accessory pancreatic ducts

MPD -- MAIN PANCREATIC DUCT
APD -- ACCESSORY PANCREATIC DUCT
CBD -- COMMON DUCT
S-SUPERIOR; I-INFERIOR; L-LEFT; R-RIGHT
Mn.DP -- MINOR DUODENAL PAPILLA
Mj.DP -- MAJOR DUODENAL PAPILLA

DISCUSSION

1. The presence of accessory pancreatic duct.

In the present study accessory pancreatic duct was present in 70% and absent in 30% of specimens. Various studies reported in literature showed a wide variation in the prevalence of accessory pancreatic duct from less than 10% to more than 90%. In a study done by Steger U¹ et al. in 2010 an additional accessory duct was found in 16% cases. Goel S² in 2015 reported

one case with two accessory ventral pancreatic ducts opening into common bile duct separately proximal to hepato-pancreatic ampulla. Such presence of multiple accessory ducts is absent in present study.

Table 8: Comparison of prevalence of the accessory pancreatic duct in present study with other studies

Name of Author	Prevalence
Berman, ^[3] (1960)	33%
Dawson and Langman, ^[4] (1961)	40%
Mc Carthy, ^[5] (1975)	21%
Karak, ^[6] (1991)	6.6%
Toda, ^[7] (1998)	42%
Sahni D, ^[8] (2001)	94.4%(M),85.7%(F)
C Aube, ^[9] (2003)	67%
Sunjidhashahriah, ^[10] (2006)	27.69%
Anterpreet K Arora, ^[11] (2011)	33.3%
Wilarusmee C, ^[12] (2013)	57.2%
Lucas N Pina, ^[13] (2013)	62%
Gabriel J. Mchonde, ^[14] (2014)	29.1%
L.C.Prasanna, ^[15] (2015)	95%
JakrapanJirasiritham, ^[16] (2016)	67.56%
Narayanan Govindraj, ^[17] (2017)	48%
Present study	70%

Type of Accessory Pancreatic Duct

In the present study, the main course of accessory pancreatic duct is short type seen in 15(42.9%) specimens and long type is next commonly seen i.e., in 8(22.9%) specimens. Ansa type is seen in 6(17.1%) specimens and the rest of the 6(17.1%) are included in others. In the study done by Dawson and Langman,^[4] in 1960, 17.5% of cases showing ansa type of accessory duct pattern were observed.

SunjidhaShahriah,^[10] et al. in 2005 reported the study of various types of accessory pancreatic duct done in 75 postmortem pancreas as straight course (50%) spindle course (27.78%) and cudgel course (22.22%).

Tehreem Fatima,^[52,18] et al. in 2010 reported one case of loop variant 1(4%) of accessory pancreatic duct in 25 pancreatic specimens.

N.Govindraj,^[17] et al. in 2017 reported one case of ansapancreatica identified in the study done in 50 cases.

In the present study the short type (42.9%) of accessory pancreatic duct is more prevalent compared to previous studies as reported by Gosavi and Gaikwad,^[19] et al. (2%), Kamisawa,^[50,22] et al. (33.2%), L.C.Prasanna,^[16] et al. (22.5%) which showed long type as a predominant course, accounting for 74%, 66.8% and 50% respectively.

Table 9: Comparison of various types of accessory pancreatic duct in present study with other studies

S.No	Name of Author	Long	Short	Ansa	Others
1.	Gosavi and Gaikwad, ^[19] (1980)	74%	2%	24%	--
2.	T.Kamisawa, ^[20] (2008)	66.8%	33.2%	--	--
3.	L.C.Prasanna, ^[60,16] (2014)	50%	22.5%	22.5%	5%
		20/40)	(9/40)	(9/40)	(2/40)
4.	Present study	22.9%	42.9%	17.14%	17.14%
		(8/35)	(15/35)	(6/35)	(6/35)

Length of Accessory Pancreatic Duct

In the present study, the mean length of the accessory pancreatic duct is 4.07cm with a standard deviation of 1.07cm. The study done by Kamisawa,^[20] et al. in 2008 stated that short type of accessory pancreatic duct has a longer length compared to long type.

According to age wise study (with group I <40 yrs and group II >40 yrs) done by Anterpreetkaur Arora,^[11] et al. in 2011, the length of the accessory pancreatic duct did not show any alteration with age.

Table 10: Comparison of length of the accessory pancreatic duct in present study with other studies

S.No	Name of Author	Range (Cm)	Mean ± Standard Deviation (CM)
1.	Anterpreetkaur, ^[11] (2011)	2.0 -- 6.2	3.89±0.85
2.	Lucas N Pina, ^[13] (2013)	0.9 – 6.5	2.94
3.	Present study	2.1 – 6.3	4.07±1.07

Width of the Accessory Pancreatic Duct

In the present study, the mean width of the accessory pancreatic duct is found to be 1.6mm with a standard deviation of 0.6mm.

According to age wise study (with group I <40 yrs and group II >40 yrs) done by Anterpreetkaur Arora,^[11] et al. in 2011, width was significantly greater in group II (1.98 ±0.020) as compared with group I (1.42 ±0.024) in male subjects and also greater in group II (1.82±0.024) as compared to group I (1.34±0.013) in female subjects. So the above study stated that aging results in the dilation of accessory pancreatic duct and this alteration is seen mainly after the sixth decade.

Table 11: Comparison of width of the accessory pancreatic duct in present study with other studies

S.No	Name of Author	Range (MM)	Average Mean (MM)
1.	Anand, ^[21] (1989)	--	1.49 ± 0.5(< 40yrs) 1.94 ± 0.69(>40yrs)
2.	R.Manfredi, ^[22] (2013)	--	1.0
3.	Lucas N Pina, ^[13] (2013)	1 - 4	1.9
4.	Present study	0.8 - 3.3	1.6±0.6

The Opening of Accessory Pancreatic Duct

In the present study, the accessory pancreatic duct opened into minor duodenal papilla in 71.4% specimens and into major duodenal papilla in 28.6% specimens.

In a study done by T.Kin,^[23] in 2005, Santorini's duct was the major drainage route of the pancreas in 22% of individuals, as it was opening into major duodenal papilla.

In the present study, the opening of accessory pancreatic duct into major duodenal papilla may be due to non-union of pancreatic ducts and may be communicated to the main pancreatic or involved in the formation of hepato-pancreatic ampulla.

Table 12: Comparison of opening of the accessory pancreatic duct into major and minor duodenal papillae in present study with other studies

Opening pf Accessory Pancreatic Duct			
S.NO	Name of Author	Major Papilla	Minor Papilla
1.	C.J. Mitchel, ^[24] (1973)	90%	10%
2.	T.Kin, ^[23] (2005)	78%	22%
3.	SunjidhaShahriah ^[10] (2006)	27.78%(5/18)	66.67%(12/18)
4.	L.C.Prasanna, ^[16] (2014)	5.3%(2/38)	94.7%(36/38)
5.	Present study	28.6%(11/35)	71.4%(24/35)

CONCLUSION

The presence of accessory pancreatic duct was noted in 70% specimens and absent in 30%.The three various courses of the accessory pancreatic duct were observed. It showed 20% long type, 45.72% short type and 17.14% ansa type and 17.14% (others) were not grouped into any of the three groups.The length of the accessory pancreatic duct was measured from its opening into the duodenum to its termination, either by uniting with main pancreatic duct or by a free ending in the lower part of head of the pancreas. The mean length and standard deviation of the accessory pancreatic duct was calculated to be 4.07 ± 1.07 cm.The width of the accessory pancreatic duct is measured approximately in the middle of its entire length. Its mean and standard deviation were calculated to be 1.6 ± 0.6 mm.The opening of the accessory pancreatic duct was observed into minor duodenal papilla in 68.6% specimens and major duodenal papilla in 31.4%.

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