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Original Article

Childhood Chronic Recurrent Headache in Hong Kong: A Case Control Study

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Abstract Childhood headache is commonly encountered in paediatric practice and can lead to significant morbidities. Local research and management consensus is lacking. This is a case control study conducted on children with primary functional headaches from a specialist outpatient clinic utilising a structured questionnaire. Headaches were classified as migraine, tension headache and nonspecific headache, according to the International Headache Society criteria. We ascertained the pattern of distribution of various functional headaches, pain characteristics, interventions and psychosocial impacts on the child and family. Subjects with migraine were compared with those with tension and nonspecific headaches, which were grouped into non-migrainous headache. The findings were appraised with reference to local and overseas literatures from adult and paediatric practices. Forty-eight consecutive subjects were recruited, in which 58.3% were diagnosed to have migraine and 41.7% with non-migrainous headache. Characteristics of childhood headaches manifest differently in children compared to adults. A high incidence of unnecessary neuroimaging and psychosocial impairment warrants overhaul of local practice in refractory headaches. Impairment in social function was found to be common in both groups.

Key words *Childhood headaches; Migraine; Neuroimaging; Psychosocial impairment*

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Introduction

Chronic recurrent headache is a common problem in office paediatric practice, but research in local population is lacking. Spontaneous remissions of childhood onset headaches were uncommon; 80% of subjects still had headaches three years later.[1] Headache in adolescence was significantly associated with report of pain and other co-morbidities in early adulthood.[2,3] An 18-year follow-up identified a three-fold increase in migraine incidence in a cohort who already had migraine at age 7.[4] Longitudinal study revealed 50% of individuals with childhood migraine continued to experience the problem 30 years later.[5]

In 2001, Kong et al[6] conducted an epidemiological study on childhood headache in primary-level school children, and established a local prevalence of 2.8%. This

is a follow-up control study on a cohort of children who were actively followed up in the same specialised centre. We aim to ascertain the pattern of distribution of various functional headaches, pain characteristics, interventions and psychosocial impacts on the child and family. Subjects with migraine were compared with those with tension and nonspecific headaches, which were grouped into non-migrainous headache. The findings were subsequently appraised with reference to local and overseas literature from adult and paediatric practices.

Methods

Questionnaire Development

The questionnaire was designed to cover domains including characteristics, intervention and outcome measures of childhood primary functional headaches.[7,8] The items for performance variables were formulated with reference to Paediatric Migraine Disability Assessment Scores (PedMIDAS).[9,10] The number of questions and items were modified after input from clinical psychologist. Answers containing nominal and ordinal information were standardised into choices. Choices were arranged in a Likert scale manner as appropriate to quantify the respondent's attitude.

Data Collection

Data was collected through questionnaire interview in a single tertiary specialist referral centre. Study subjects included children and adolescents aged 6 to 18 years old with primary functional headaches actively followed up in a paediatric neurology clinic from 1st November 2018 to 31st January 2019. The primary recurrent functional headaches were classified as migraine, tension headache and unclassified recurrent headache by the two paediatric neurologists in charge of the service, according to diagnostic criteria adapted from the International Headache Society (Table 1). Isolated headache attack and secondary headaches associated with sinusitis, intracranial lesions, head injury, psychiatric disorders and epilepsy were not recruited. Subjects with intellectual disability and ethnic minorities who could not communicate in English or Chinese were excluded.

Convenient consecutive samples were recruited during follow-up consultation. The principal investigator obtained written informed consent from the parents or guardians of eligible subjects. The same principal investigator conducted the questionnaire to the subject without any suggestions to the choice of answer. While the questions were standardised, the verbal content was adjusted according to the child's developmental age, and answers were only interpreted and entered by the principal investigator. If the patient did not understand the content of any particular enquiry item, that item was explained to the parents or guardians to assist explanation to the child, but any suggestions to the choice of answer was disallowed. Failure to complete the items on headache characteristics would preclude further interview, and the incomplete questionnaire would not be included for subsequent analysis. Supplementary information was obtained from the case file and electronic patient record.

Information obtained included the type of functional headache, demographic information, headache characteristics (frequency, duration, intensity, location, quality, precipitating factors, associated symptoms), interventions and effectiveness of treatments, and degree of impairment on social function.

Data Analysis and Ethics Approval

Subjects with migraine were compared with those with non-migrainous headache. In bivariate analysis, categorical data were compared using Chi-square and Fisher's exact tests. Normally distributed data were analysed by independent sample t-test. Non-normally distributed data were analysed by Mann-Whitney *U* test. Statistical significance was defined as two-tailed probability below 0.05. All statistical analyses were performed using the Statistical Package for the Social Sciences (Windows version 9.0; SPSS Inc, Chicago [IL], US).

This study did not involve any intervention that might harm study subjects. There was no financial incentive. The study was compliant with International Council for Harmonization - Good Clinical Practice (ICH-GCP). The questionnaire sheets and the data were only handled by the Principal Investigator. Personal identification information was omitted in the questionnaire sheet to protect privacy and minimise bias. The study protocol was approved by the Ethics Committee of Kowloon West Cluster of Hospital Authority, Hong Kong. Informed consent was obtained from respective parents.

Results

The study was conducted from 1st November 2018 to 31st January 2019. Among the 52 consecutive subjects who fulfilled the inclusion criteria, we obtained informed

consents in 48 subjects, giving a response rate of 92.3%. The reasons to decline participation included limitation of time for interview, failure in understanding the purpose of the study and parental worries of adverse effects of participation on subsequent headache management. Twenty-eight children (58.3%) were diagnosed to have migraine, and 20 children (41.7%) with non-migrainous headache, including 7 (14.5%) tension-type headache and 13 (27.2%) unclassified recurrent headache.

Table 2 shows the demographic data of the two comparison groups. The mean age of onset of migrainous headache was 11.57±3.44 years, which was significantly higher (P=0.012) than that in the non-migrainous group (9.05±3.12 years). Eighty-nine percent (25/28) of migrainous patients had onset after age 9, while the onset was before age 9 in 55% (11/20) of non-migrainous patients. There was no significant gender difference between the two groups (P=0.558).

Table 1 Diagnostic criteria of migraine and tension headache adapted from the International Headache Society

Migraine	**Tension type headache**	**[#]Unclassified recurrent headache**
At least 5 attacks fulfilling criteria below 1. Headache duration 4 to 72 hours (2 to 48 hours in children) 2. Headache characterised by at least 2 of the followings: A. Unilateral location B. Pulsating quality C. Moderate or severe intensity (inhibits or prohibits daily activity) D. Aggravated by climbing stairs or similar routine physical activity 3. At least one of the followings A. Nausea and / or vomiting B. Photophobia and phonophobia	At least 10 previous attacks fulfilling criteria below: 1. Headache duration 30 minutes to 7 days 2. Headache characterised by at least 2 of the followings: A. Pressing (non-pulsating) nature B. Mild or moderate intensity (may inhibit, but not prohibit activity) C. Bilateral location D. No aggravation by walking stairs or similar physical activity 3. Both of the followings: A. No nausea or vomiting B. Photophobia and phonophobia are absent, or only one is present	Recurrent functional headache that do not fulfil diagnostic criteria for either migraine or tension type headache, or contain overlapping features from either condition at the time of classification

[#] This entity is arbitrarily defined by the authors to facilitate analysis in the present study. The underlying pathology may be heterogeneous and does not represent a well-defined clinical diagnostic entity.

Table 2 Demographics of migraine and non-migrainous headache

	Migraine (n=28)	**Non-migrainous headache (n=20)**	**P-value**
Age (year)			
5-8	3	11	
9-11	10	5	
12-14	7	4	
15-17	8	0	
Gender			
Female	15	9	0.558
Male	13	11	
Mean onset age (SD) in year	11.57 (3.44)	9.05 (3.12)	0.012
Family history (1st degree relatives)			
Yes	16	10	0.624
No	12	10	

Table 3 shows the characteristics of headache in the two study groups. Majority of children from the migrainous group (53.5%) and non-migrainous group (70%) experienced two or more attacks per month (P=0.251). Nearly 70% of children with migraine reported headache duration longer than two hours, compared to only 30% in the non-migrainous group (P=0.001). Children in the migrainous group reported higher average headache intensity score than the comparison group (6.7 vs 5.4, P=0.007). No significant difference was found between the two groups in reporting lateralisation of pain (P=0.558). Sixty percent of migrainous children had throbbing ache, compared to 15% in the comparison group (P=0.003). Symptoms that were significantly more common in the migrainous group than the non-migrainous group included nausea (71% vs 30%, P=0.005), photophobia (71% vs 30%, P=0.005), phonophobia (50% vs 5%, P=0.001), and preceding aura (57% vs 15%, P=0.003). No significant difference was found between the two groups with reference to vomiting (P=0.111) and dizziness (P=0.430). No significance between group differences was identified in common aggravating factors, namely tiredness, sleep deprivation, physical activity, caffeine, negative mood and stress.

Table 4 summarises the investigations and interventions. Neuroimaging (CT or MRI) had been performed in 60% of subjects in either group (P=0.960). All but one child from either group were relieved from headache by rest or sleep (P=0.807). Significant higher proportion of children with migraine required abortive medications in comparison to non-migrainous patients (96% vs 65%, P=0.004). For both migraine and non-migrainous headache, more than half of children only took abortive medication once in a month or less. The most commonly used abortive treatment was paracetamol in both groups (68% vs 55%, P=0.691). Naproxen was used as abortive medication at significantly higher rate in migrainous patients (54% vs 15%, P=0.005). With respect to preventive therapy, over 60% of children with migraine had been put on prophylactic medications, compared to none in the comparison group (P<0.001). The most commonly used preventive medication was pizotifen. Second line prophylaxis included amitriptyline, propranolol, topiramate and acetazolamide. Four children with refractory migraine were referred to clinical psychology and their clinical details were given in Appendix. None from the non-migrainous group received psychotherapy.

Table 5 summarises the effect on performance and functioning. Most children with migraine (71%) or non-migrainous headaches (75%) did not take sick leaves in last 6 months (P=0.698). However, impairment in function was common in both groups, with a trend for migrainous children to report more negative effects on school-work (96% vs 75%, P=0.067), mood (75% vs 55%, P=0.070) and participation in social activities (50% vs 30%, P=0.081).

Discussion

Headache is common in adults and children, but local studies are scarce. Yu et al[11] surveyed the health status of teenagers in Kwai Tsing district of Hong Kong and revealed headache to be one of the commonest problems in medical consultations in preceding 3 months among 55% of studied subjects. Kong et al[6] conducted a questionnaire survey in 2120 primary school pupils, revealing chronic headache in 2.8% respondents, with tension-type headache 1.2%, migraine 0.5%, probable migraine 0.7%, and unclassified headache 0.5%. A community based study which was conducted in Hong Kong adolescents aged 15 years and older estimated that the prevalence of migraine, tension-type headache and nonspecific headache were 3%, 1.5%, and 0.4% respectively.[12] Ng et al[13] conducted a telephone interview on 1051 Cantonese speaking adults. Chronic pain was identified in 113 respondents, with headache (21%) following back pain (34%) as the second commonest problem.

Surveys in children via mails or telephone may be confounded by poor response rate, misinterpretation, leading question bias and recall bias.[14-16] In the present study, direct structured interview in a specialist clinic setting helped to minimise bias and allowed in-depth exploration on the impacts on the child and family. Chan et al[17] conducted a retrospective review on 66 adult migrainous patients managed in specialist neurology clinic. Eighty percent were females with mean age of onset before 30; 12% had positive family history and 42% had migraine aura. Aggravating factors included menstruation in 26%, stress in 18%, and sleep deprivation in 13%. That was compared to the present study conducted in similar setting on migrainous children, showing less female preponderance (54%), more familial predisposition (57%) and higher incidence of aura (57%). Aggravation by stress (57%) and sleep deprivation (57%) appeared more common than adults, though not significantly different from that in non-migrainous children. The difference between local adults and children may represent the complex interplay between genetic and environmental factors in migraine manifestation across the age spectrum.

Table 3 Characteristics of pain and accompanying symptoms in migraine and non-migrainous headache

Pain characteristics and symptoms		Migraine (n=28) (%)	Non-migrainous headache (n=20) (%)	P-value
Frequency of attacks in previous 6 months / month				
>=2/month		15 (53.5)	14 (70.0)	0.251
<=1/month		13 (46.4)	6 (30.0)	
Pain duration				
<1 hour		5 (17.9)	11 (55.0)	0.001
1-2 hours		4 (14.2)	5 (25.0)	
2-4 hours		11 (39.3)	3 (15.0)	
>=4 hours		8 (28.6)	1 (5.0)	
Location				
Unilateral (either side / always same side)		15 (53.5)	9 (45.0)	0.558
Others (bilateral / occiput / face)		13 (46.4)	11 (55.0)	
Pain quality				
Throbbing / pulsating		17 (60.7)	3 (15.0)	0.003
Others (dull / constricting / tingling)		11 (39.3)	17 (85.0)	
Pain intensity (Numerical rating ranging from 0 [no pain] to 10 [worst pain])				
Mild (1-4)		2 (7.1)	5 (25.0)	
Moderate (5-10)		26 (92.9)	15 (75.0)	
Average pain score		6.71	5.4	0.007
Symptoms				
Nausea	Yes	20 (71.4)	6 (30.0)	0.005
	No	8 (28.6)	14 (70.0)	
Vomiting	Yes	10 (35.7)	3 (15.0)	0.111
	No	18 (64.3)	17 (85.0)	
Nausea and vomiting	Yes	10 (35.7)	3 (15.0)	0.111
	No	18 (64.3)	17 (85.0)	
Photophobia	Yes	20 (71.4)	6 (30.0)	0.005
	No	8 (28.6)	14 (70.0)	
Phonophobia	Yes	14 (50.0)	1 (5.0)	0.001
	No	14 (50.0)	19 (95.0)	
Dizziness	Yes	18 (64.3)	15 (75.0)	0.43
	No	10 (35.7)	5 (25.0)	
Aggravation				
Physical activity	Yes	3 (10.7)	2 (10.0)	0.936
	No	25 (89.3)	18 (90.0)	
Tiredness / sleep deprivation	Yes	16 (57.1)	13 (65.0)	0.583
	No	12 (42.9)	7 (35.0)	
Caffeine	Yes	3 (10.7)	1 (5.0)	0.48
	No	25 (89.3)	19 (95.0)	
Negative mood	Yes	13 (46.4)	7 (35.0)	0.428
(e.g. anxious, depressed)	No	15 (53.5)	13 (65.0)	
Stress (e.g. study)	Yes	16 (57.1)	8 (40.0)	0.242
	No	12 (42.9)	12 (60.0)	
Aura	Yes	16 (57.1)	3 (15.0)	0.003
	No	12 (42.9)	17 (85.0)	

Table 4 Investigations and interventions for migraine and non-migrainous headache

	Migraine (n=28) (%)	Non-migrainous headache (n=20) (%)	P-value
Investigation			
Ever had CT / MRI scan for headache			
Yes	17 (60.7) (13 for CT; 4 for MRI)	12 (60.0) (12 for CT; 0 for MRI)	0.96
No	11 (39.2)	8 (40.0)	
Interventions			
Relief after rest / sleep			
Yes	27 (96.4)	19 (95.0)	0.807
No	1 (3.6)	1 (5.0)	
Abortive therapy			
Yes	27 (96.4)	13 (65.0)	0.004
No	1 (3.6)	7 (35.0)	
Number of days in one month with medications taken to relieve headache			
0-1	16 (57.1)	13 (65.0)	0.606
2-4	8 (28.6)	5 (25.0)	
5-7	3 (10.7)	2 (10.0)	
>=8	1 (3.6)	0	
Medications taken most often and their effectiveness			
Paracetamol	19 (67.9)	11 (55.0)	0.691
Naproxen	15 (53.5)	3 (15.0)	0.005
Ibuprofen	2 (7.1)	2 (10.0)	0.663
Preventive therapy			
Yes	18 (64.3)	0	<0.001
No	10 (35.7)	20 (100.0)	
Medications taken most often and their effectiveness			
Pizotifen	14 (50.0)	0	
Amitriptyline	5 (17.8)	0	
Propranolol	4 (14.2)	0	
Topiramate	3 (16.7)	0	
Acetazolamide	2 (11.1)	0	
Clinical psychology	4 (14.2)	0	0.081

Table 5 Performance variables in children with migraine and non-migrainous headache

Variables	Migraine (n=28) (%)	Non-migrainous headache (n=20) (%)	P-value
School days missed in last 6 months			
0	20 (71.4)	15 (75.0)	0.698
1-2	5 (17.9)	3 (15.0)	
3-4	3 (10.7)	2 (10.0)	
Difficulty to do schoolwork	27 (96.4)	15 (75.0)	0.067
Mood affected	21 (75.0)	11 (55.0)	0.07
Difficulty to maintain social activities	14 (50.0)	6 (30.0)	0.081
Interpersonal relationship affected	8 (28.5)	4 (20.0)	0.551

In the present study, migraine onset was less common in the first decade of life and became more prevalent during adolescence (Table 2). This is consistent with findings in previous epidemiological studies.[6,15,18] According to the International Headache Society (IHS) criteria, migraine readily differentiates from other functional headaches by characteristics, duration, location, quality, intensity, aggravating factors and associated symptoms (Table 1). We found that pulsating quality, nausea, photophobia and phonophobia had higher differentiating values for childhood migraine. However, classic migraine features such as lateralising ache, longer duration and worst intensity were also present in non-migrainous headaches, while common aggravating factors were prevalent in both groups (Table 3). In contrast, Anttila et al[14] found that unilaterality, pulsating quality, photophobia and aggravation by physical activity had doubtful predictive values for childhood migraine. These contrasting findings illustrate the difficulty to apply strict IHS criteria in the diagnosis of childhood migraine, particularly during the early stage of disease. Paediatricians should take into consideration the contexture of symptoms, behavioural changes, evolutions over time and parental information to arrive at the correct diagnosis.[19]

Sixty percent of subjects from either group had undergone neuroimaging in this study. That was significantly higher than the imaging rate of 16.7% from overseas reports on migrainous children.[20] Kan et al[21] reviewed the appropriateness of 88 CT brain in 82 paediatric headache patients from Tuen Mun Hospital of Hong Kong within a six-month audit period. Isolated headache or migraine, classified as low level of appropriateness according to the American College of Radiology Appropriateness criteria,[22] accounted for 22% of the brain scans performed. The high incidence of unnecessary neuroimaging for functional headache across the territory may reflect social and cultural misconceptions and that warrants enhanced education and development of clinical practice guidelines.[21]

Ninety-six percent of migrainous children in the present cohort had regular use of common analgesics or nonsteroidal anti-inflammatory drugs (NSAIDs). Chan et al[17] reported that triptans, paracetamol, NSAIDs and ergots were effective abortive treatments in their local series of 66 migrainous adults. Triptans is a group of selective serotonin receptor agonists at the 5-HT1B and 1D receptor sites.[23] It is recommended for moderate to severe headache unresponsive to analgesics or NSAIDs.[24] The US Food and Drug Administration (FDA) and the European Medicines Agency (EMA) approved four triptans for use in migrainous children, namely almotriptan, rizatriptan, sumatriptan and zolmitriptan. Oral rizatriptan and almotriptan are recommended in children ≥6 years and in adolescents ≥12 years respectively. EMA approved nasal sumatriptan in children ≥5 years old and zolmitriptan nasal spray in adolescents ≥12 years old. Contraindications to use of triptans include vascular conditions (e.g. stroke, hypertension, Raynaud syndrome), current intake of monoamine oxidate inhibitors or ergotamines, impaired renal or liver function and pregnancy. It cannot be repeated more than once within 2 hours of first dose ingestion and cannot be taken more than two times per week and six times per month.[25,26] Side effects include warm sensation, fatigue, dizziness, tingling, chest tightness and somnolence.[27] In the present study, there were no migrainous children taking triptans as abortive treatment and the proposed reasons included the less availability, higher costs and less experience in use of triptans among local paediatric neurologists. Multi-centre survey is worth to ascertain the role of triptans in the treatment algorithm for local children.

Preventive medications were used in 64% of migrainous children in the current study. In general, incapacitating headache attacks over 3-4 times a month warrant prophylaxis.[27] Pizotifen, amitriptyline and propranolol were the most common preventive medications. The choice was similar to local adult series, with propranolol (59%), pizotifen (55%) and tricyclic antidepressants (43%) achieving ≥40% reduction in attacks.[17] Evidence-based guidance to the selection of medications is lacking. No significant difference in efficacy had been demonstrated in amitriptyline and topiramate compared to placebo.[28] Similarly, flunarizine, pizotifen, propranolol and valproate were shown to be ineffective in episodic migraine.[29] The choice of medications in children still relies largely on experience and personal preference.

Secular increase in chronic childhood headache over the past two decades has been correlated to factors such as increase in time demands, pressures from school, peers and family, and reduction in physical activities.[1,4,15,30] The psychosocial impacts could be immense. School absences, academic problems and social dysfunction impaired psychosocial development and self-esteem.[31] Co-morbid depressive, anxiety, and somatization disorders were common.[14,32,33] Significant impacts were also demonstrated in non-migrainous children.[34] In the present study, impairment of daily functioning was equally prevalent in migrainous and non-migrainous children (Table 5), with

over half of the subjects from either group having mood disturbances and difficulties in schoolwork. Kernick et al reported an average of 6 days of missing school per year.[35] In contrast, over 70% of the present cohort did not miss school. The discrepancy between the high incidence of mood disturbance and low rate of school absence might reflect enthrallment with academic performance and fear of stigmatisation in society. Further studies may explore the role of parental expectation in this paradox between school attendance and mood disturbance.

Behavioural treatment had become standard intervention for adult migraine and tension-type headache. Emerging studies and meta-analyses also demonstrated efficacy of psychotherapy in childhood headache.[36-38] A randomised controlled trial demonstrated cognitive behavioural therapy (CBT) plus amitriptyline resulted in greater reductions in headache days and migraine-related disability compared with headache education plus amitriptyline.[39] CBT might also augment the efficacy of standard medications in childhood migraine.[38] In the current study, despite the high incidence of psychosocial impairment, only 14% of migrainous children received psychotherapy, compared to none from the non-migrainous group (Table 5 and Appendix). The under-utilisation of psychotherapy may be related to lack of physician awareness of this intervention to children with severe refractory headaches. The confined availability of clinical psychological service in our locality also limits its use. Further studies are required to ascertain the role of psychotherapy and the underlying factors hindering timely referral, with overhaul of practice guidelines accordingly to improve care in refractory headaches.

The small sample size limited the power of this study. Children with unclassified headache might evolve into migraine, resulting in crossover bias. Recall bias with reference to the timing and intensity might be present in interviewing younger children and children with longstanding diseases. Informant might under-report medication overuse, which was prevalent in chronic headaches.[40] Findings from a single specialist centre might not be generalised to other services in the territory. Territory-wide multi-centre research is warranted to guide future management and helps to establish a standard practice guideline for local children.

Declaration of Interest

The authors declare that they have no financial or other conflicts of interest in relation to this publication.

References

1. Straube A, Henien F, Ebinger F, von Kries R. Headache in school children: prevalence and risk factors. Dtsch Arztebl Int 2013;110: 811-8.
2. Guidetti V, Galli F. Evolution of headache in childhood and adolescence: an 8-year follow-up. Cephalalgia 1988;18:449-54.
3. Brattberg G. Do pain problems in young school children persist into adulthood? A 13-year follow-up. Eur J Pain 2004;9:187-99.
4. Sillanpaa M, Anttila P. Increasing prevalence of headache in 7-year-old school children. Headache 1996;36:466-70.
5. Bille B. A 40-year follow-up of school children with migraine. Cephalagia 1997;17:488-91.
6. Kong CK, Cheng WW, Wong LY. Epidemiology of headache in Hong Kong primary-level schoolchildren: questionnaire study. Hong Kong Med J 2001;7:29-33.
7. Anttila P, Metsahonkala L, Helenius H, Sillanpaa M. Predisposing and provoking factors in childhood headache. Headache 2004; 40:351-6.
8. Heinrich M, Morris L, Kroner-Herwig B. Self-report of headache in children and adolescents in Germany: possibilities and confines of questionnaire data for headache classification. Cephalalgia 2009;29:864-72.
9. Hershey AD, Powers SW, Vockell ALB, LeCates S, Kabbouche MA, Maynard MK. PedMIDAS: development of a questionnaire to assess disability of migraines in children. Neurology 2001;57: 2034-9.
10. Kroner-Herwig B, Heinrich M, Vath N. The assessment of disability in children and adolescents with headache: Adopting PedMIDAS in an epidemiological study. Eur J Pain 2010;14: 951-8.
11. Yu CM, Chiu MC, Lau JTF, et al. Adolescent health profile in Kwai Tsing Hong Kong. HK J Paediatr (new series) 1996;1: 207-20.
12. Wong TW, Wong KS, Yu TS, Kay R. Prevalence of migraine and other headaches in Hong Kong. Neuroepidemiology 1995;14:82-91.
13. Ng KFJ, Tsui SL, Chan WS. Prevalence of common chronic pain in Hong Kong adults. Clin J Pain 2002;18:275-81.
14. Anttila P, Metsahonkala L, Aromaa M, et al. Determinants of tension-type headache in children. Cephalalgia 2002;22:401-8.
15. Laurell K, Larsson, Eeg-Olofsson O. Prevalence of headache in Swedish schoolchildren, with a focus on tension-type headache. Cephalalgia 2004;24:380-8.
16. Korner-Herwig B, Heinrich M, Morris L. Headache in German children and adolescents: a population-based epidemiological study. Cephalalgia 2007;27:519-27.
17. Chan KH, Cheung RTF, Ho SL. Characteristics of local migraine patients. HK Pract 1999;21:26.
18. Abu-Arafeh I, Razak S, Sivaraman B, Graham C. Prevalence of headache and migraine in children and adolescents: a systematic review of population-based studies. Dev Med Child Neurol 2010; 52:1088-97.
19. Kelly M, Strelzik J, Langdon R, DiSabella M. Pediatric headache: overview. Curr Opin Pediatr 2008;30:748-54.
20. Lipton RB, Manack A, Ricci JA, et al. Prevalence and burden of chronic migraine in adolescents: results of the chronic daily headache in adolescents Study (C-dAS). Headache 2011;51:693-706.
21. Kan EYL, Wong IYC, Lau SPC. Audit of appropriateness and

outcome of computed tomography brain scanning for headaches in paediatric patients. J HK Coll Radiol 2005;8:202-6.
22. Expert Panel on Pediatric Imaging. ACR Appropriateness Criteria® Headache-Child. J Am Coll Radiol 2018;15:S78-90.
23. Hershey AD. Current approaches to the diagnosis and management of paediatric migraine. Lancet Neurol 2010;9:190-204.
24. O'Brien HL, Kabbouche MA, Hershey AD. Treating pediatric migraine: an expert opinion. Expert Opin Pharmacothr 2012;13: 959-66.
25. Papetti L, Spalice A, Nicita F, et al. Migraine treatment in developmental age: guidelines update. J Headache Pain 2010; 11:267-76.
26. Bonfert M, Straube A, Schroeder AS, Reilich P, Ebinger F, Heinen F. Primary headache in children and adolescents: update on pharmacotherapy of migraine and tension-type headache. Neuropediatrics 2013;44:3-19.
27. Diener HC, Kaube H, Limmroth V. A practical guide to the management and prevention of migraine. Drugs 1998;56:811-24.
28. Powers SW, Coffey CS, Chamberlin LA, et al. Trial of amitriptyline, topiramate and placebo for pediatric migraine. N Engl J Med 2017;376:115-24.
29. El-Chammas K, Keyes J, Thompson N, Vijayakumar J, Becher D, Jackson JL. Pharmacologic treatment of pediatric headaches: a meta-analysis. JAMA Pediatr 2013;167:250-8.
30. Carrie C, Hurrelmann K, Settertobulte W, Smith R, Todd J, editors. Health Policy for Children and Adolescents (HEPCA) Series No. 1. Copenhagen: WHO Regional Office for Europe, 2000.
31. Powers SW, Patton SR, Hommel KA, Hershey AD. Quality of life in childhood migraines: clinical impact and comparison to other chronic illnesses. Pediatrics 2003;112:e1-e5.
32. Milde-Busch A, Boneberger A, Heinrich S, et al. Higher prevalence of psychopathological symptoms in adolescents with headache. A population-based cross-sectional study. Headache 2010;50:738-48.
33. Pitrou I, Shojaei T, Chan-Chee C, Wazana A, Boyd A, Kovess-Masfety V. The associations between headaches and psychopathology: a survey in school children. Headache 2010;50: 1537-48.
34. Rossi LN, Cortinovis I, Meneqazzo L, Brunelli G, Bossi A, Macchi M. Classification criteria and distinction between migraine and tension-type headache in children. Dev Med Child Neurol 2001; 43:45-51.
35. Kernick D, Campbell J. Measuring impact of headache in children: a critical review of the literature. Cephalalgia 2009;29:3-16.
36. Eccleston C, Morley S, Williams A, Yorke L, Mastroyannopoulou K. Systemic review of randomized controlled trials of psychological therapy for chronic pain in children and adolescents, with a subset meta-analysis of pain relief. Pain 2002;99:157-65.
37. Trautmann E, Lackschewitz H, Kroner-Herwig B. Psychological treatment of recurrent headache in children and adolescents-a meta-analysis. Cephalalgia 2006;26:1411-26.
38. Ng QX, Venkatanarayanan N, Kumar L. A systemic review and meta-analysis of the efficacy of cognitive behavioural therapy for the management of pediatric migraine. Headache 2017;57: 349-62.
39. Powers SW, Kashikar-Zuck SM, Allen JR, et al. Cognitive behavioral therapy plus amitriptyline for chronic migraine in children and adolescents: a randomized clinical trial. JAMA 2013; 310:2622-30.
40. Van Driel M, Anderson E, McGuire T, Stark R. Medication overuse headache: strategies for prevention and treatment using multidisciplinary approach. Hong Kong Med J 2018;24:617-22.

Appendix. Clinical information of patients with migraine and their clinical psychological intervention

Case 1

YLS, 17-year-old female adolescent, was referred from Accident and Emergency Department to paediatric neurology clinic for chronic headache since 9 years of age. For initial presentation, she suffered from frontal headache with frequency of three times a week and duration of lasting 1 hour. She could not describe pain nature at that time. The headache was associated with dizziness, vertigo and vomiting. There was no aura or photophobia. She had no family history of migraine or headache. The headache persisted more than a year before seeking medical help. Physical examination was unremarkable. Computed tomography of brain was arranged and the result was unremarkable. The working diagnosis was tension-type headache. Abortive treatment with NSAIDs was offered initially. On subsequent follow-up, the headache symptoms did not improve much with abortive medications. Prophylaxis with amitriptyline was initiated but only mild improvement was noted. Subsequently, she also started to have episodes of shortness of breath, increase in severity of dizziness and numbness of limbs without weakness. Corresponding investigations including blood investigations, lung function test and nerve conduction study were performed and unremarkable. She also started to develop photophobia during headache attacks. Diagnosis of headache was amended to migraine. Multiple prophylactic medications including amitriptyline, pizotifen, topamax and diamox were tried but minimal improvement was noted. She relied on abortive treatments with nearly daily consumption of analgesics and NSAIDs. On enquiry to psychological components, she admitted there was increased stress from school and severe headache attack was usually preceded by school examination. She also disclosed her worries on her father's illness who was diagnosed with nasopharyngeal carcinoma. Referral to clinical psychologist was made and she started to attend clinical psychologist since age of 16 years. The patient's mood, adjustment to headaches and coping methods towards stress were reviewed. She was facilitated to weigh the pros and cons of consuming analgesics by herself. Psychoeducation on cognitive behavioural therapy (CBT) (e.g. relationship between thoughts, emotions, physical sensations, behaviours) and diaphragmatic breathing relaxation exercise were introduced, demonstrated and practised. For progress, she reported that she continued to experience headaches every day with moderate intensity; however, she had developed acceptance towards headaches already. There was no marked distress or mood disturbances related to her headaches. The effect of headache on activity of daily living became less significant. She was currently followed up by paediatric neurologists with prophylactic treatment and clinical psychologist for psychological intervention.

Case 2

AST, 15-year-old female adolescent, was referred from private paediatrician to paediatric neurology clinic for continual management of migraine since 12 years of age. She presented with headache localised to parietal region with aura of scintillation. The pain was dull and lasted more than an hour. It was associated with vomiting but not photophobia or phonophobia. The headache attack was infrequent and occurred once every few months. Physical examination was unremarkable and no brain imaging was performed. Because of infrequent attacks, abortive treatment with paracetamol was suggested without indication for prophylaxis. When promoting to Form 1 in secondary school, she reported recurrent abdominal pain apart from headache. The symptoms occurred more frequently during school days and became exaggerated in school examination period. She was symptoms free during school holidays. Psychological component was suspected and clinical psychologist referral was made. Clinical psychological assessment identified her stressor was related to high maternal expectation on her academic performance. Relaxation training and promotion of self-understanding were offered. She understood better for mind-body relationship. She foresaw possible academic stress and claimed she would strive to acquire newly learned skills including relaxation skills for coping. On follow-up, she reported she had no more migraine attacks and no recurrences of abdominal pain. No more clinical psychological intervention was required and she was currently followed up in paediatric neurology clinic without abortive treatment.

Case 3

NLL, 17-year-old female adolescent, was referred from private general practitioner to paediatric neurology clinic for suspected tension type headache since 14 years of age. She presented with headache localised to occipital region with gripping in nature. The pain occurred in the morning and lasted 1-2 hours. It was associated with back pain and precipitated by stress and sleep deprivation. She did not complain of vomiting, photophobia or phonophobia. Physical examination was unremarkable. Computed tomography of brain was subsequently arranged and the result was unremarkable. She was started with abortive treatment and later added on prophylactic treatment (amitriptyline) because of increasing frequency and severity of headaches. Diagnosis was for review because of increasing severity of headache and evolving symptoms of phonophobia. Migraine was the diagnosis instead of tension type headache. Several medications for prophylaxis including pizotifen, topamax and amitriptyline were tried but she could not tolerate the side effects such as sleepiness and slow mentality. In view of intolerance to prophylactic drugs, clinical psychological intervention was recommended. Clinical psychological assessment revealed anxiety proneness in social situations, e.g. at school and with strangers on street, and low self-esteem. CBT for social anxiety and mood management were offered. She was guided to differentiate thoughts from reality and offered cognitive restructuring for her catastrophic thoughts. Subsequently no more clinical psychological intervention was needed. She was currently followed up in paediatric neurology clinic with use of abortive treatment for headache.

Case 4

TWH, 13-year-old male adolescent, was referred for consultation in paediatric neurology clinic after repeated hospital admissions for non-specific dizziness and headache since age of 11 years. The headache was located to bilateral temporal area, throbbing in nature and in severe intensity. It could last from 30 minutes up to whole day. It was associated with dizziness and palpitations but no aura, phonophobia nor photophobia reported. Physical examination was unremarkable. Subsequent investigations for palpitation and dizziness and magnetic resonance imaging of brain were normal. Migraine was diagnosed later due to increasing severity of symptoms. Prophylaxis with pizotifen and abortive treatment with NSAIDs were offered. In view of the presence of somatic symptoms (palpitation and dizziness), clinical psychological intervention was recommended. Psychological assessment revealed academic stress related to promotion to secondary school and psychoeducation on mind-body relationship was briefly explained. However, the patient's father declined further clinical psychological intervention after first assessment when the child's bullying issue was disclosed. The patient was currently followed up in paediatric neurology clinic with pizotifen prophylaxis and headache's condition was stable.