

15 questions and answers about pediculosis capitis. Pediculosis pubis.

Is it true that pediculosis capitis affects poor and dirty people?

No, it is not true. Mummified head lice have been found on the hair of Pharaoh mummies (8) and pediculosis capitis is widespread in all developed countries.

This prejudice is responsible for severe psychological trouble in the affected families, thus discouraging the reporting of new cases and eradicating of epidemics.

What about the morphological characteristics of head lice?

When alerting parents during an epidemic,

mothers often say they never saw lice before and they do not know how lice look.

Head lice are hematophagous ectoparasitic insects, lacking wings and provided with a sucking buccal apparatus. They are about 3 millimeters long -the male 0.3-0.4 millimeters less than female-, thus visible to the naked eye. Their body is segmented with the head apparently fused to the thorax (Fig. 1600), three pairs of segmented legs, specialized in maintaining and moving the insect on the hair, and finally the abdomen, where segments are more evident.

The color of head lice is brownish, more or less dark according to the color of the hair of the



Fig. 1600: Head louse, female. You can clearly see the 14 breathing spiracles, as small round white spots in the abdomen, an egg in the making and the 2 gonopods creating an invaginated V-shaped ending in the last segment.

host. The ventral surface of the female louse is uniformly colored, whereas that one of the male louse presents hyperpigmented transversal bands.

However, the movability of the louse is its most important characteristic, making its identification easier. Something moving on the hair is really the best signal for the observer. The head louse is a good runner, traveling up to 23 centimeters per minute (7). However, when disturbed, the head louse quickly hides deeply under the hair, making itself invisible. The last event especially occurs at the onset of the infestation, when the lice are few.

How does the louse breathe?

Breathing spiracles are evident on both sides of its segmented body, between the first and second pair of legs of the thorax and level with the following six segments, except for the last one (Fig. 1600). From the breathing spiracles start the tracheae, 7 for each side, which branch into progressively smaller ramifications and carry oxygen to all the districts of the body. These elements are important from a therapeutical point of view.

How does the louse feed?

The head louse feeds on the blood of the host

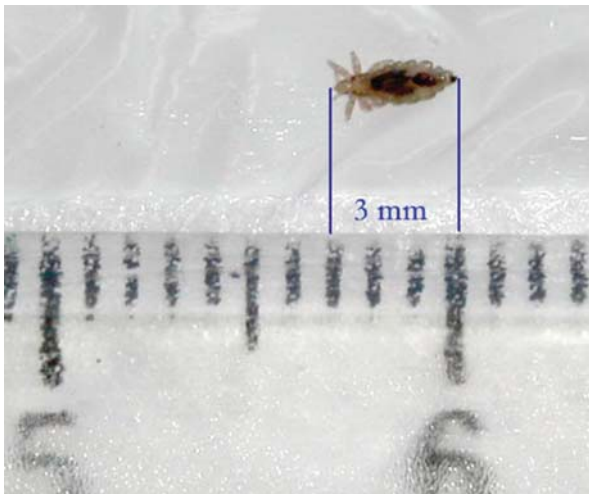


Fig. 1601

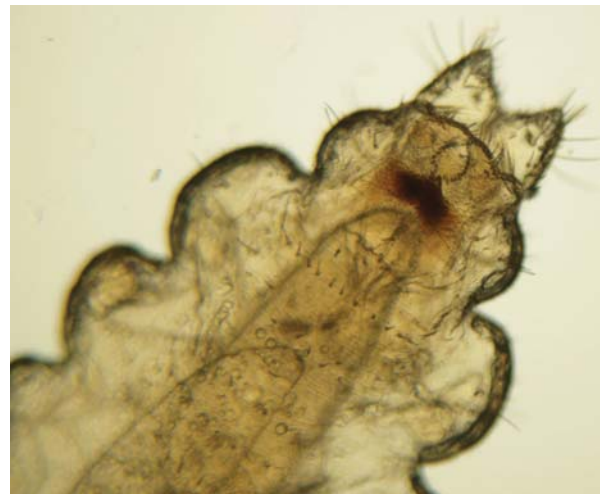


Fig. 1602



Fig. 1603

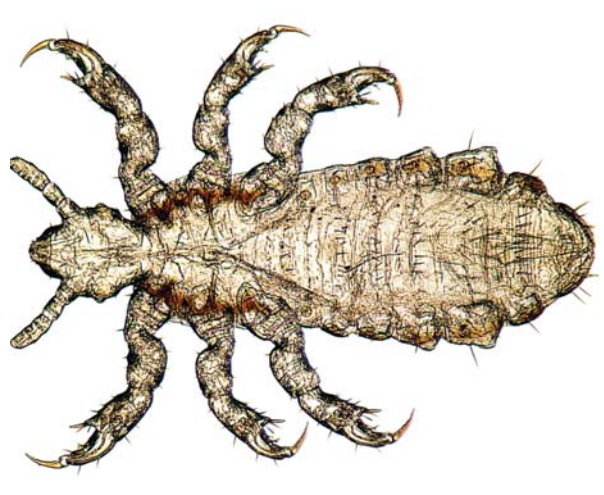


Fig. 1604

Fig. 1601, 1602, 1603, 1604: The head louse is about 3 mm long (Fig. 1601). In Fig. 1602 2 eggs are about to be eliminated through the gonopods. The caudal ending of the male, both adult (Fig. 1603) and nymph (Fig. 1604), is convex.



Fig. 1605

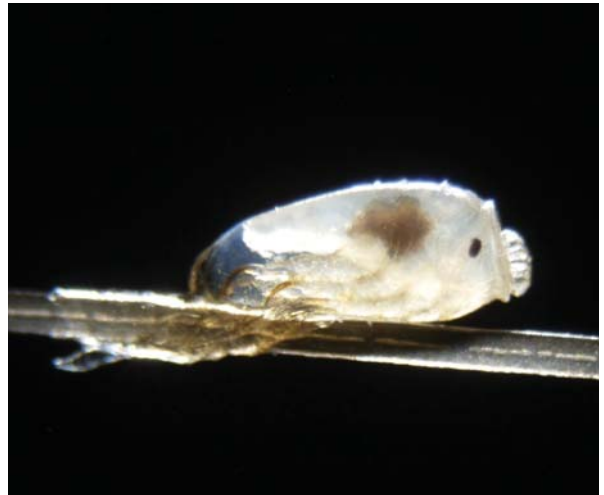


Fig. 1606

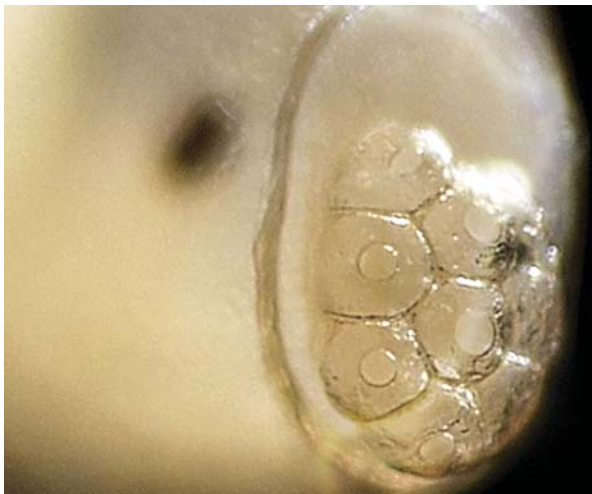


Fig. 1607

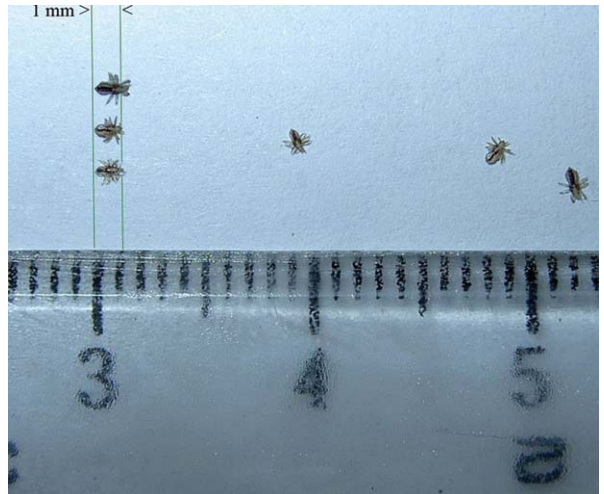


Fig. 1608

Fig. 1605, 1606, 1607, 1608: Viable nits (Fig. 1605, 1606) cemented to the hair, in different phase of development. In Fig. 1607 you can see the structure of the head louse nit operculum. In Fig. 1608 you can see nymphs sized about 1 mm.

and is able to make all the acts of its life, from feeding to copulation, grasping at the hairs and moves with its legs from one hair to another of the same subject or of different subjects, provided they are close to each other with their hair. The buccal apparatus contained in a proboscis (haustellum) consists of a hollow rostrum formed by two jaws and by a prepharynx. Another narrow longitudinal duct starts from the salivary glands and goes through the prepharynx. The louse feeds by hooking the extremity of its head to the skin of the host with the little teeth of the haustellum. It alternatively sets in action its jaws and prepharynx to make a hole into the skin,

then it injects into the latter its saliva, which contains vasodilating and anticoagulant substances, and finally it sucks up the blood flooding the wound. The saliva is responsible for allergic reactions in sensitized subjects (3).

What is the life cycle of the head louse?

The head louse is hemimetabolic in development as its larval stage looks like a baby adult. Shortly after hatching from the nit, the nymph, which is about 1.5 mm long, feeds on human blood and through three molts, within 9-12 days, becomes an adult louse. At this moment its sex can be verified, the female ending with an inva-

ginated V, whose two branches are related to the gonopods. The latter actively participate in the deposition of the egg, allowing its perfect alignment on the hair. After about one day the adult female starts to couple (5) and after another day to lay eggs. The latter process occurs 3 to 10 times per day, so that she can lay in her lifetime -about one month- as many as 300 eggs. Before the egg a secretion flows from the genital opening. The latter solidifies in the air, cementing the egg to the hair close to the follicle opening on the scalp, with its operculum always facing the distal ending of the hair (6). There is no known solvent able to melt this cement, whose aminoacidic composition is similar to that one of the hair shaft (1). The nit hatches in about 10 days. The nymph goes out from the nit like a cork from a bottle of champagne, making the operculum to go up (7).

How is the infestation transmitted?

Pediculosis capitis is not highly contagious as well as some infectious diseases. The infestation is transmitted only through a fertilized adult female or more individuals of different sex, who can grasp the hairs of the new host. This is possible only when the hair of two different subjects, one of whom affected by pediculosis capitis, are very close to each other (Fig. 1609). There are not other modalities of contagion because head lice do not jump and, being devoid of wings, do not fly. The contagion through combs, hairbrushes, hairbands and clothes is not frequent, because the head louse survives less than 20 hours when it is removed from the human scalp. The last event is less exceptional during summertime, because, when it is cold, the head louse can hardly leave the warm environment of the scalp.

Is it important the length of the hair or the sex of the host in the transmission of the infestation?

The length of the hair is a favoring factor only because people with long hair usually devote more time to their hair and more easily can use an infested hairbrush or comb. In case of equal length of hair, the sex does not affect the frequency of pediculosis capitis.



Fig. 1609: A teacher comforts an infested little girl thus exposing herself to the risk of contagion.

Is the age important in the transmission of the infestation?

Yes, it is. Pediculosis capitis affects more frequently the nursery and elementary school, probably due to the increased frequency of physical contact at this age. However, also adolescents and adults can be infested by children.

What are the symptoms of pediculosis capitis?

Active pediculosis may be asymptomatic for several days, especially in subjects who have not had previous contact with the saliva of lice. This is why, when there is a case of pediculosis capitis within a group, all the other subjects of the same group should be examined, although asymptomatic. In case of a second infestation the subject is more precociously affected by pruritus, probably due to an allergic reaction to the saliva of the louse.

The first symptom is pruritus. The intensity of the latter varies according to the individual susceptibility and previous contacts. Erythematous, 2-3 millimeters in size papules may be present (Fig. 1610). In the most severe cases excoriations (Fig. 1611), secondary pyoderma (Fig. 1612), lymphadenopathy (Fig. 1613), febricula, irritability and fatigue -due to loss of sleep because of increased itching during the night time- and rarely anemia.



Fig. 1610



Fig. 1611

Fig. 1610, 1611, 1612, 1613: Pediculosis capitis: you can see erythematous papules on the neck (Fig. 1610), excoriated dermatitis of the neck (Fig. 1611), pyoderma secondary to scratching and suprainfection with *Staphylococcus aureus* (Fig. 1612) and satellite lymphadenopathy (Fig. 1613).



Fig. 1612



Fig. 1613



Fig. 1614: Examination in case of suspected pediculosis.



Fig. 1615: A louse can be hardly seen on the hair.



Fig. 1616: How to use a fine-tooth comb.

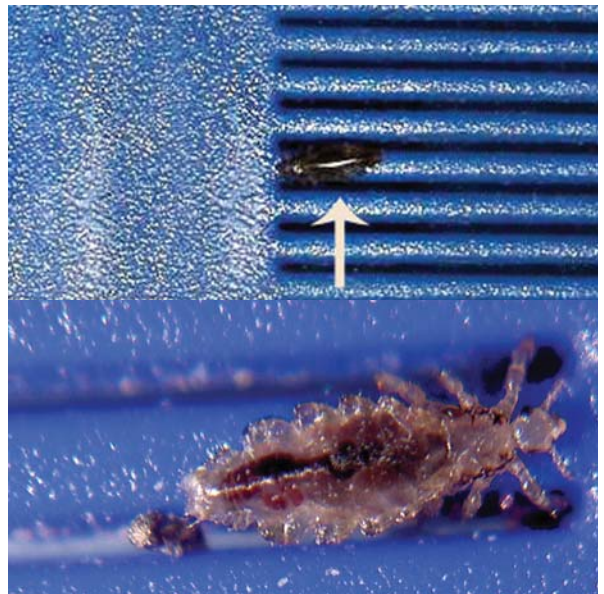


Fig. 1617: A louse between the teeth of the comb.

What are the pathognomonic signs of pediculosis capitis?

The evidence of mobile lice on examination (Fig. 1615) or more easily after combing the patient hair with a fine-tooth comb (Fig. 1616, 1617) is a clue to the diagnosis of pediculosis, although rarely present. The examiner must stay behind the subject to be examined and carefully look at his/her hair, first of all in the retroauricu-

lar-occipital region (Fig. 1614), which is the primary and preferential site of infestation. When viable lice cannot be seen, the examiner should pass the fine-tooth comb on all the hairs, observing every time the comb to unveil some lice possibly inserted between the teeth of the comb. In subjects with long hair, it is better to vaporize water first, then to brush hair to remove possible knots and finally to use the fine-tooth comb.

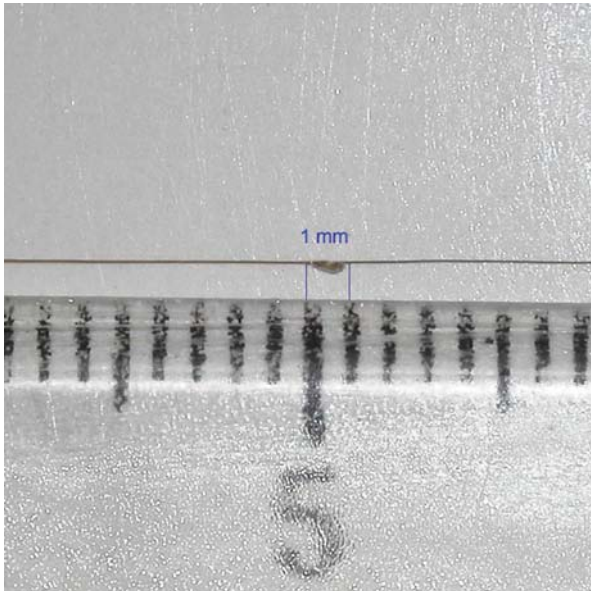


Fig. 1618: Size of the nit.



Fig. 1619: Brownish, viable nit cemented to the hair.



Fig. 1620: Transparent, empty nit without operculum.

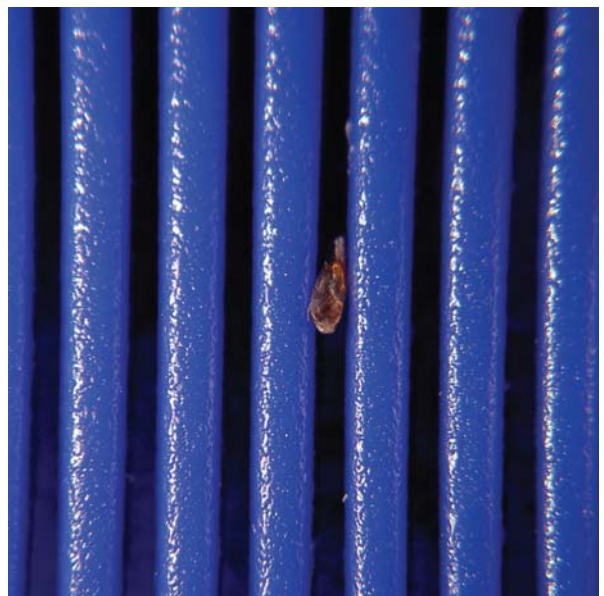


Fig. 1621: Nit inserted in fine-tooth comb for nits.

More frequently, 0.8x0.3mm (Fig. 1618), variably colored grains stuck to the hair can be seen. The latter are more or less far from the follicular orifice, namely the point where the hair goes out from the scalp. These grains are the nits or eggs laid by the adult female. These pear-shaped nits are stuck on one side of the hair like a flag on its mast (Fig. 1619), although the cement winds like a sleeve all the hair. In contrast with

the common dandruff, it is not possible to remove the nit from the hair with a blow of the index. When the examiner, running the hair between his/her index and thumb, arrives to the nit, he/she feels a clear obstacle (positive stop test). The nit can hardly run along the longitudinal axis of the hair and can be unthreaded from its distal ending, when it is located several centimeters far from the scalp. The color of the nit is



Fig. 1622: Viable, brownish nit, stuck to the hair, a few millimeters far from the scalp.



Fig. 1623: Empty, whitish nits, more than 1 centimeter far from the scalp.

brownish when it is inhabited by a viable larva, whereas it gets whitish (Fig. 1620) when the nymph left it. The nits which are less than 6-10 mm far from the scalp are brownish and inhabited (Fig. 1622), whereas the nits which are more than 1 cm far from the scalp are whitish and empty (Fig. 1623).

This datum can be easily remembered when taking into account that the egg is laid by the pregnant female level with the scalp and that it progressively goes away from the scalp gradually with the growing of the hair. As the hair grows 0.3-0.4 mm a day and the egg needs 10 days before hatching, one can understand that a nit far more than 1 cm from the scalp is almost inevitably empty.

What can be confused with pediculosis?

The most frequent differential diagnosis is between nits and dandruff.

Dandruff (Fig. 1624) can be easily removed from the hair even with blows transversal to the longitudinal axis of the hair, given by the fingers of the examiner. The nit does not move with these blows and sometimes can be only hardly unthreaded along the longitudinal axis of the hair.

Even *cosmetic residua* can be for the same reason differentiated from nits.



Fig. 1624: Scale of dandruff with irregular shape.

Hair casts (Fig. 1625), for instance those ones associated to traction alopecia (11), consist of whitish keratin masses that wind the hair like a horny cylinder (Fig. 1627). Hair casts are more hardly differentiated from nits, because also they are hardly movable and can only run along the longitudinal axis of the hair. Hair casts are thinner -0.1 to 0.3 mm- and of variable length -0.3 to 4 mm-. Moreover, in contrast with nits, hair casts are not pear-shaped nor translucent and finally completely wind the hair.

When facing pyoderma or eczematous lesions, especially located on the retroauricular and occipital region, pediculosis capitis should be always suspected and searched for.

Can the head louse transmit infectious diseases?

Group A streptococcus pyogenes and coagulase-positive Staphylococcus aureus are present on the external surface of the lice and in their feces. The mechanism of transmission is not the bite of the louse. On the other hand, the contagion is due to the contact of eroded skin with the feces or with the crushed body of the insect contaminated by bacteria. Pyoderma (Fig. 1612) is the most frequent complication. There is not clinical evidence of transmission of virus diseases or other infectious disorders.



Fig. 1625: Hair casts (courtesy of Zhang and Zhu M.D.).



Fig. 1626: Pseudonit (arrows) around a hair.

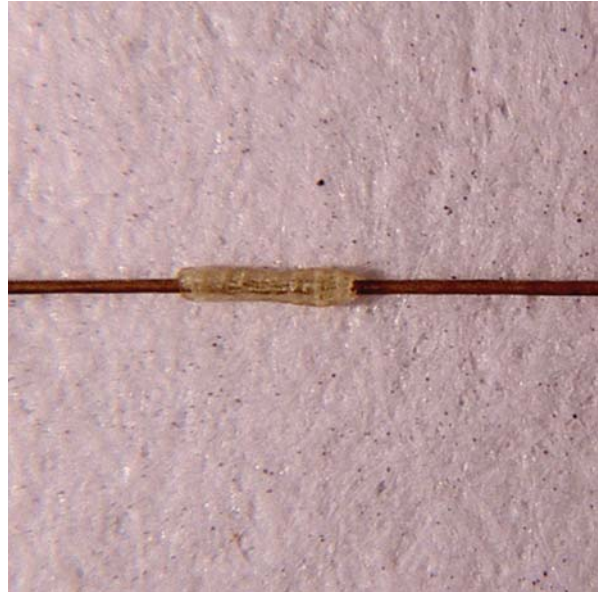


Fig. 1627: Horny cylinder made of keratin.

Is it possible to prevent pediculosis?

It is not possible to definitely eliminate pediculosis, as it was possible with some infectious diseases thanks to vaccination.

The persistence of pediculosis is probably related to the capability of lice to develop resistance against a pediculicide agent, before a

new agent is introduced on the market. Therefore prevention consists of early diagnosis and treatment of subjects at risk when a new case is diagnosed in a family or social group. The treatment, which is not always devoid of side effects, follows the confirmed diagnosis of pediculosis capitis.



Fig. 1628

Fig. 1628, 1629: Possibly infested toys, which cannot be washed, are closed for 10-15 days in a plastic bag.



Fig. 1629

After the treatment of infested subjects, it is useful to consider the objects that can be contaminated from a theoretical point of view. Taking into account that a temperature higher than 55°C for five minutes is lethal for lice and nits, the clothes theoretically contaminated will be washed in a washer machine.

Brushes and combs will be washed with a pediculicide agent or immersed for 5 minutes in water at 55°C. The objects that do not tolerate this temperature can be closed in a plastic bag for 10-15 days (Fig. 1628). An environment disinfection -furniture, chairs, sofas, etc.- is not useful.

What is the treatment of pediculosis capitis?

Taking into account the possible side effects of most pediculicide agents, first of all we underline that these agents must be used only in case of confirmed infestation. On the other hand, they must not be used for the prophylaxis of subjects at risk.

Physicians should also remember that pediculicide agents are not surely effective on nits. This is why a second treatment is mandatory after 1-2 weeks to be sure that all the viable nits hatched and therefore all the possible parasites were eliminated.

Finally, physicians should take into account the usage of a fine-tooth comb. The latter is useful not only for the diagnosis. Daily passing the hair with a fine-tooth comb is really useful to monitor the efficacy of the treatment (Fig. 1630). The common fine-tooth combs allow to trap only adult lice, but they are not able to unthread the nits. A comb able to trap the nits has non-deformable teeth spaced not more than 0.3 mm between each other (Fig. 1621), better when having a roundish ending to enter the hair without injuring the skin. Metal combs can be sterilized in boiling water and therefore used again. The elimination of nits is easier when wetting the comb or better the hair with a solution of vinegar 50% in water. The latter seems to lessen the adhesion of the nit to the hair.

Natural pyrethrins are extracts of “*chrysanthemum cinerariaefolium*”, whose effectiveness against lice is well known from millennia. Pyrethrin, jasmolin and cinerin are their active



Fig. 1630: Monitoring the treatment with fine-tooth comb.

substances. Their activity is related to their blocking effect, although of short duration, on the nervous system of the insect. Due to their short effect, since 1950 pyrethrins are always associated to piperonyl butoxide. The latter prolongs the nervous block till causing the death of the louse. Moreover, it is also able to prevent the development of resistance. Pyrethrins are not very resistant to heat and light, are not totally ovicidal and, finally, although rarely, may be responsible for allergic dermatitis due to repeated usage and for respiratory disorders in atopic subjects with pollinosis.

Permethryn is a synthetic pyrethroid derived from natural pyrethrins, resistant to heat and light and 3 times less toxic for mammals as compared with natural pyrethrins. It is on sale with the name of Nix (®) or in generic drugs as 1% cream. Being provided with a persistent activity, initially in the '80ies only one application for 10 minutes was effective. Today the well documented resistance of lice to the drug (9) makes a second application after 7 days necessary.

Malathion is an organophosphate which irreversibly inhibits cholinesterase. It is the quickest acting product on the louse. However, it is potentially toxic, as well documented in agriculture with the pesticides. Malathion is available

as alcoholic solution, gel and shampoo. The initially advised time of application for the alcoholic solution was about 12 hours during night. However, the smell of the product was responsible for headache under these conditions. Today the gel is used for ten minutes twice with an interval of one week.

Carbaryl is another inhibitor of cholinesterase with low toxicity for mammals. It is used in lotion for long periods of time -even 24 hours- or as a shampoo with the same modalities of malathion.

Lindane is an organochlorine very commonly used in the past as shampoo for 4 minutes or alcoholic lotion during night time. A second application is necessary after 7 days. Today lindane is infrequently used due to various reasons. It is not biodegradable, thus accumulating in the human body and in the environment. Moreover, it is potentially neurotoxic due to incorrect usage or ingestion and, finally, induces resistance.

Recently, a new product consisting of natural oils -anise oil, coconut oil and ylang ylang oil- raised marked interest because it acts occluding the tracheal lumen of lice and thus inducing their death by suffocation. The product has a good pediculicide activity (6). It must be sprayed and kept on the hair 15 minutes every 5 days for three times. It is apparently non toxic and does not induce resistance.

Recently it has been shown that the ingestion of cotrimoxazole (sulfamethoxazole-trimethoprim), has pediculicide activity, probably because the antibiotic, arriving with the blood of the host in the intestine of the louse, kills the symbiotic bacteria, which are essential for utilizing a so specialized diet. Unless the infested child is also affected by pyoderma, this antibiotic association is not indicated for the treatment of pediculosis.

What is the function of the families, teachers and physicians?

The family is the first moving force in the fight against pediculosis. However, in many cases, families should be properly educated by physicians about the modalities of contagion, the indication to the treatment and, finally, its

modalities. The parents themselves certify that the first pediculicide treatment has been carried out or that it has not been made because their child is not infested. This way the child does not lose any school day.

The teachers inform the parents about the presence of confirmed cases of pediculosis within the school and thus about the opportunity that their child undergoes an examination to unveil a possible infestation. The teachers also give the parents the first information regarding the infestation, when requested. In particular cases of persistent infestation, the teachers can ask for a medical certificate of non contagiousness.

The school physician and the pediatrician give the family more detailed information about the infestation and visit the child and his relatives with possible infestation, using preferentially the fine-tooth comb to ensure a right diagnosis. When requested, physicians give the parents a certificate of non contagiousness.

Pediculosis pubis in children

Pediculosis pubis is an infestation caused by *Phthirus pubis*. In the sexually mature subjects the infestation is transmitted by sexual contagion, involving the hairs of pubis, and, in the hairy males, the perianal and axillary region, the beard, the scalp and the hairs of the trunk. In children *Phthirus pubis* is transmitted by innocent contagion and the most frequently affected regions are the free border of the eyelid and the retroauricular area level with the hair line.

Phthirus pubis is shorter than head louse - being about 1 mm long- and stockier, with the abdominal segments fused between each other, resembling a crab. The second and third pair of legs end with gross claws (Fig. 1634), perfectly adapted to the coarse, widely spaced hairs of the pubis. On the fused abdominal plates there is the same number of respiratory spiracles as in head louse. Its movements are much slower as compared with the latter. This is why it runs not more than 10 cm a day. However, it is able to move from the pubis to the head, although slowly. This explains the presence on the trunk of "maculae ceruleae" (Fig. 1637). The latter



Fig. 1631

Fig. 1631, 1632: Pediculosis of the pubis in adolescent. You can notice the involvement of the axillary region (Fig. 1631), where you can see many living lice (Fig. 1632).



Fig. 1632

cannot be seen in other infestations. *Phthirus pubis* can remain stuck to the skin sucking the host blood for hours or days. This behavior, which is reminiscent of ticks, is responsible for the greater importance of the clinical lesions (7).

With regard to the modalities of contagion, even though in adults the sexual intercourse is the most frequent event, the indirect transmission through the infested underwear, bed and toilette, is more frequent than for head louse. *Phthirus pubis* can really survive for 36 hours at a temperature of 22°C. Moreover, the viable eggs taken from infested patients can hatch after 10 days at a temperature of 29-31°C with a relative humidity of 70%.

Pruritus in the infested areas, usually the pubis, is the first symptom, which is responsible for a medical consultation in the sexual mature subject. When the patients undresses, the pre-

sence of black dots on the underwear, especially when it is light colored, is a clue to the diagnosis.

When carefully looking at the pubic region, better with a magnifying glass, the examiner notices black dots, sometimes mobile, on the hairs near the skin. When removing the hair with the black dot and putting it on a slide (Fig. 1634), physicians realize to face *Phthirus pubis*. Its unmistakable aspect is better appreciated under the microscope. Therefore, physicians should search for the parasite on the other hairy regions (Fig. 1632), try to identify the source of the infestation and, finally, prescribe the treatment.

In the prepubertal child the modalities of contagion are different and usually associated to innocent contact with relatives or to indirect contagion with infested underwear. Also the cli-

nical features in children are different. Bluish patches (maculae ceruleae) on the trunk (Fig. 1637) are often the first symptom responsible for a dermatological consultation. The latter are probably related to the migration of the louse and to its bite with extravasation of red blood cells and hemosiderinic pigment in the dermis (10). Although asymptomatic, these maculae attract attention of the mothers more than the nits and parasites almost always simultaneously present on the eyelashes (Fig. 1633, 1635). When facing bluish patches on the trunk in a child, physicians should first of all look at the eyelashes, searching for mobile parasites, nits and feces, more easily visible with the aid of a 10x magnifying glass. A positive finding confirms without any doubt the diagnosis of maculae ceruleae, ruling out other more rare disorders, such as ashy dermatitis, cutaneous amiloidosis and fixed drug eruption. When the child arrives to the medical consultation due to the presence of pruritus and inflammation of the eyelids, constitutional blepharitis of atopic

should be ruled out. The latter usually last for a longer time and is characterized by irregular crusted lesions, without a well definite shape. Moreover, a magnifying glass allows to rule out the presence of nits and lice.

Besides the involvement of eyelashes, lice, nits and feces should be searched for even in other sites, in children mainly on the hair line level with the area around the ear (Fig. 1636). When facing black dots in these areas, the typical signs of the infestation should be searched for with a magnifying glass.

The treatment of pediculosis of the pubis is similar to that one of pediculosis capitis. Radical cure such as the depilation of hairy regions are not necessary, although largely carried out. In very hairy males 5% permethrin should be applied throughout the skin surface, included the scalp, can be useful.

Particular attention should be paid to the treatment of phthiriasis of the eyelids. In this site the potential toxicity of pediculicides should be particularly considered. In this site most



Fig. 1633: Phthiriasis of the eyelids. You can see two Phthirii and some nits.

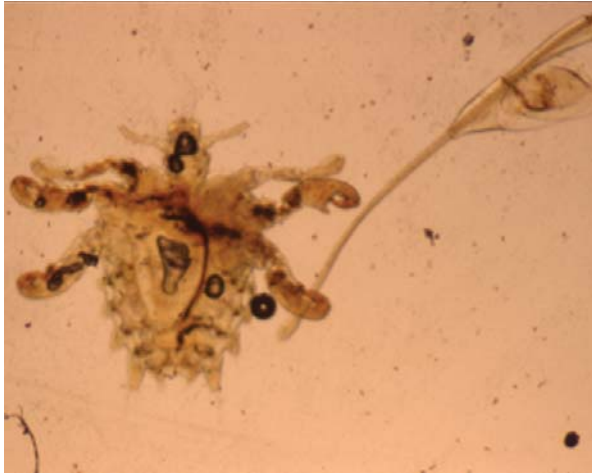


Fig. 1634



Fig. 1635

Fig. 1634, 1635, 1636, 1637: Louse of the pubis grasping a hair, on which it has already laid an egg (Fig. 1634). In children the infestation mainly affects the eyelashes (Fig. 1635, courtesy of prof. Patrizi). However, also the hair line around the ear (Fig. 1636) can be affected. Maculae ceruleae on the trunk (Fig. 1637) are often the first symptom responsible for a dermatological consultation.



Fig. 1636



Fig. 1637.

treatments used for pediculosis capitis and pubis are contraindicated. Also the mercury yellow oxide ophthalmic ointment should be avoided. Although requiring time and patience, the best treatment is white petrolatum ointment. It should be applied on the eyelashes with a cotton stick, which is dragged from the proximal to the distal extremity of the latter. This way lice and feces could be removed, whereas nits are resistant to this treatment. This is why the treatment should be repeated three times a day for 8-10 days, till the disappearance of parasites and eggs. Due to the difficulty of this treatment, in some selected cases, especially when facing a suprainfection, a treatment with sulfamethoxazole-trimethoprim per mouth for 10 days is indicated. Alternatively, in countries where it is available, ivermectin 200 mg/kg twice with an

interval of one week can be used (2). The last oral treatments are also indicated in the cases non responding to the common treatment, which can be more easily observed in immunocompromised subjects, particularly affected by AIDS (4).

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