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Helicobacter pylori and skin disorders: a comprehensive review of the available literature

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Abstract. – *Helicobacter pylori* is a Gram-negative bacterium identified for the first time about 30 years ago and commonly considered as the main pathogenic factor of gastritis and peptic ulcer. Since then, it was found to be associated with several gastrointestinal and extra-gastrointestinal diseases. *Helicobacter pylori* is also associated with many skin disorders including, but not limited to, chronic urticaria, rosacea, lichen planus, atopic dermatitis, psoriasis, pemphigus vulgaris, vitiligo, primary cutaneous MALT-type lymphoma, sublamina densa-type linear IgA bullous dermatosis, primary cutaneous marginal zone B-cell lymphomas and cutaneous T-cell pseudolymphoma. Literature up to September 2020 shows that clear evidence exists only for some of the mentioned associations, while in the majority of cases, data appear contrasting. The aim of this review is to summarize the available studies on the topic and draw possible conclusions. Further clinical and laboratory studies are needed to assess the real plausibility and relevance of these associations, as well as the possible role of *Helicobacter pylori* with the underlying pathogenic mechanisms.

Key Words:
Helicobacter pylori, Chronic urticaria, Rosacea, Psoriasis, Vitiligo.

Introduction

Helicobacter pylori (*Hp*) was firstly described by Bizzozero[1] about 90 years ago as a Gram-negative, flagellate, microaerophilic bacterium originally found in the stomach of dogs affected by gastritis and peptic ulcer. This finding showed that some bacteria survive in the gastric environment[2-4]. Therefore, it changed the approach to these disorders, which were now of microbial etiology rather than stress-related[1]. McColl[5] showed a high prevalence of *Hp* infection in the general population and its multiple links with the human organism and functions. Among infected subjects, around 70% is asymptomatic, 10-23% develops peptic ulcer, 1-3% gastric carcinoma, and <1% gastric MALT (mucosa-associated lymphoid tissue) lymphoma[6].

Hp does not act only at the gastric level. The strength of association between extra-gastric diseases and *Hp* is variable. Up to date, *Hp* has been hypothesized to be responsible for several conditions, including hepatic and pancreatic disorders, chronic bowel diseases, hematologic conditions, cardiovascular diseases, neurological diseases, lung disorders, ocular diseases, obesity, type 2 diabetes mellitus, growth retardation, extra gastric MALT lymphoma[7-11].

Hp has been found during investigations on several skin disorders, and a possible cause-effect relation was postulated[7-9]. Herein, we review and discuss the available studies about the possible role of *Hp* in diseases of dermatological interest.

Materials and Methods

We checked the PubMed and EMBASE databases using the string "Helicobacter AND skin", without time limits. Only papers written in the English language were included. The references retrieved were critically examined by two experts

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in the field of dermatology to select those pertinent, reporting data on humans (type of article: case reports, case series, case-control, cross-sectional and cohort studies, trials, systematic reviews, meta-analyses) about the association between *Hp* and skin diseases. Based on the type of study, the strength of evidence for each article reviewed was graded (Table I).

Table I. Strength levels assigned to different types of study in the evaluation of the reviewed articles (1=highest, 11=lowest).

Type of article	Strength level
Meta-analysis	1
Systematic review	2
Double-blind trial	3
Single-blind trial	4
Open-label trial	5
Prospective cohort study	6
Retrospective cohort study	7
Case-control study	8
Cross-sectional study	9
Case series	10
Case report	11

Results

As of September 23rd, 2020, our search in the PubMed and EMBASE databases retrieved 383 articles, of which only 143 were considered relevant. First author, year of publication, type of study, study population and strength level of each article are summarized in Table II.

Chronic Urticaria

Chronic urticaria (CU) is a frequent skin disorder, affecting about 1% of the general population[12]. Despite careful clinical investigation and extensive laboratory screening, CU often remains idiopathic and treatment is ineffective.

The possible causal correlation between *Hp* and chronic urticaria (CU) has been widely studied and debated. Since the beginning, studies yielded discordant or even contrary results[13,14].

Kalas et al[15] revealed the presence of 17 *Hp*-positive individuals (42.5%) in a cohort of 40 patients affected by CU. The presence of *Hp* was generally linked to the gastrointestinal system but, after eradication of *Hp*, the authors highlighted a reduction in number and duration of urticaria flares, with a decrease in antihistamine drugs. However, it should be noticed that the same percentage is also found in a healthy age-matched population.

Similarly, other papers[16-18] reported improved symptoms of CU in a variable percentage of patients included in studies treated for *Hp* infection. This partially explains Yadav's recommendation[19] to look for *Hp* gastrointestinal infection before diagnosing Chronic Idiopathic Urticaria (CIU). Dennis et al[20] carried out a case-control study that confirmed this recommendation.

Subsequently, Fukuda et al[21] screened 50 CIU patients for *Hp*, finding 26 positive individuals. All of them were treated with eradication therapy, which was successful in 17 cases. In this group, 6 had complete remission of CIU symptoms, while 11 showed only partial remission. On the other hand, only 2 patients belonging to the not-eradicated group showed partial remission, while 7 did not improve at all. Other authors[22,23] carried out similar studies, obtaining consistent results.

More recently, Magen et al[24], as well as Başkan et al[25], explored the relationship between the improvement of CU after successful eradication therapy and the results of autologous serum skin test. These two studies independently concluded that there is no correlation between them.

On the other hand, Sun et al[26] hypothesized that anti-*Hp* antibodies are only indirectly related to CIU pathogenesis, since their prevalence is not significantly different between CIU patients, acute urticaria ones and healthy controls. To prove their point, they showed that anti-Fc-epsilon-RI antibody positivity rate is significantly ($p < 0.01$) higher in anti-*Hp* antibody positive CIU patients than in acute urticaria patients or healthy controls. Moreover, Moreira et al[27] showed that a high titer of urea breath test (UBT) seems to correlate with the improvement of CU after eradication. Lugović-Mihić et al[28] analyzed their laboratory findings, related factors and outcomes recorded after two years of workup and treatment over a 6-years period. Their results show that, compared to controls, CU patients had a significantly higher risk of testing positive for *Hp*, having allergies, increased IgE, and thyroid disorders.

There are also many researches[29-35] showing contrasting evidence about *Hp* involvement in the pathogenesis of CIU. In particular, Valsecchi et al[29] reported a high prevalence of *Hp* in CIU patients but did not highlight any improvement in CIU symptoms after its eradication. Both Daudén et al[30] and Sianturi et al[31] showed that CIU patients and controls have a similar prevalence of positive UBT, with similar titers. Fi-

Table II. Papers on the correlation between *Helicobacter pylori* (HP) and diseases of dermatological interest.

Authors, year and reference number	Type of study	Study population	Strength level
Chronic urticaria			
Varga et al[13] 1992	Case report	1 HP+ patient	11
Kalas et al[15] 1996	Open-label	40 patients with chronic "gastrointestinal urticaria"	5
Di Campli et al[16] 1998	Open-label	42 patients with chronic idiopathic urticaria	5
Shiotani et al[17] 2001	Open-label	88 HP+ patients with skin diseases, of which 26 with chronic urticaria	5
Sakurane et al[18] 2002	Open-label	198 patients with skin diseases resistant to conventional therapies, of which 50 with chronic urticaria	5
Yadav et al[19] 2008	Open-label	68 patients with chronic idiopathic urticaria	5
Dennis et al[20] 2020	Case-control	55 patients with chronic urticaria and 55 healthy controls	8
Fukuda et al[21] 2004	Open-label	50 patients with chronic idiopathic urticaria and 100 healthy controls	5
Wedi et al[22] 1998	Open-label	100 patients with chronic urticaria	5
Wustlich et al[23] 1999	Open-label	30 HP+ patients with chronic urticaria	5
Magen et al[24] 2007	Open-label	78 patients with chronic urticaria, of which 21 HP+ and with positive autologous serum skin test (ASST), 24 HP+ with negative ASST, 33 HP- and with negative ASST	5
Başkan et al[25] 2005	Case series	47 patients with chronic idiopathic urticaria	10
Sun et al[26] 2014	Case-control	100 patients with chronic idiopathic urticaria, 100 patients with acute urticaria, 100 healthy controls	8
Moreira et al[27] 2003	Open-label	21 patients with chronic idiopathic urticaria	4
Lugovic-Mihic et al[28] 2019	Case-control	160 patients with chronic urticaria and 30 controls with psoriasis vulgaris	8
Valsecchi and Pigatto[29] 1998	RCT	125 chronic urticaria patients, of which 78 HP-positive; among these 78, 31 received eradication therapy, 34 received no therapy (control group), and 13 neglected the study	3
Daudén et al[30] 2000	Open-label	25 patients with chronic urticaria and 25 healthy controls	5
Sianturi et al[31] 2007	Case-control	16 patients with chronic urticaria and 16 healthy controls	8
Schnyder et al[32] 1999	RDBPC, crossover	46 patients with chronic idiopathic urticaria	3
Akashi et al[33] 2011	Open-label	82 patients with chronic urticaria and 17 with prurigo chronica multiformis	5
Rojo-Gutiérrez MI et al[34] 2015	Cross-sectional	35 patients with chronic urticaria	9
Magen et al[35] 2013	Case series	831 patients with chronic urticaria	10
Tan et al[37] 2016	Case-control	211 patients with chronic spontaneous urticaria and 137 normal subjects	8
Rosacea			
Sharma et al[41] 1998	Case-control	45 patients with rosacea and 43 healthy subjects	8
Bamford et al[42] 1999	RDBPC	42 patients with rosacea enrolled, of which 20 underwent active treatment and 22 placebo	3
Herr and You[43] 2000	RDBPC	50 patients with rosacea and 50 healthy controls	3

Table continued

Table II. (Continued). Papers on the correlation between *Helicobacter pylori* (HP) and diseases of dermatological interest.

Authors, year and reference number	Type of study	Study population	Strength level
Szlachcic et al[45] 1999	Open-label	60 patients with rosacea and 60 controls	5
Boixeda de Miquel et al[46] 2006	Open-label	44 patients with rosacea	5
Diaz et al[47] 2003	Case series	49 patients with rosacea	10
Argenziano et al[48] 2003	Case series	48 patients with rosacea	10
Gravina et al[49] 2015	Open-label	90 patients with rosacea and 90 healthy controls	5
Agnoletti et al[50] 2016	Case-control	60 patients with rosacea and 40 healthy controls	8
Mayr-Kanhäuser et al[51] 2001	Case report	1 HP+ patient with rosacea resistant to usual dermatological treatments	11
Daković et al[52] 2007	Open-label	7 HP+ patients with ocular rosacea	5
Egeberg et al[53] 2017	Retrospective cohort	49,475 patients with rosacea and 4,312,213 general population controls	7
Utaş et al[54] 1999	Open-label	25 patients with rosacea and 87 healthy controls	5
Al Balbeesi and Halawani[55] 2014	Open-label	50 patients with rosacea, of which 11 HP-positive	5
Jorgensen et al[56] 2017	Meta-analysis	Meta-analysis of 14 studies including 928 patients with rosacea and 1527 controls	1
Saleh et al[57] 2017	Open-label	160 patients with rosacea of 872 HP-positive	5
Henoch-Schönlein purpura			
Reinauer et al[66] 1995	Case report	1 patient with Schönlein-Henoch purpura and chronic active gastritis with erosions, HP+	11
Mozrzymas et al[67] 1997	Case report	A child with Schönlein-Henoch purpura, bleeding duodenal ulcer and Helicobacter pylori-associated gastritis	11
Machet et al[68] 1997	Case report	1 patient with Schönlein-Henoch purpura and gastric Helicobacter pylori infection	11
Cecchi and Torelli[69] 1998	Case report	1 patient with Schönlein-Henoch purpura associated with duodenal ulcer and gastric Helicobacter pylori infection	11
Grivceva-Panovska et al[70] 2008	Case report	1 patient with Henoch-Schönlein purpura and Helicobacter pylori infection	11
Mytinger et al[71] 2008	Case report	A child with Henoch-Schönlein purpura associated with Helicobacter pylori infection	11
Hoshino[72] 2009	Case report	1 patient with Henoch-Schönlein purpura accompanied by gastric Helicobacter pylori infection	11
Ulas et al[73] 2012	Case report	1 patient with Henoch-Schönlein purpura and gastric Helicobacter pylori infection	11
Xiong et al[74] 2012	Meta-analysis	Meta-analysis of 10 studies including 749 children with Henoch-Schönlein purpura and 560 controls	1
Novák et al[75] 2003	Case-control	11 patients with Henoch-Schönlein purpura and 20 healthy controls	8
Idiopathic thrombocytopenic purpura			
Stasi et al[80] 2009	Meta-analysis	Meta-analysis of 25 studies including 1555 patients, of whom 696 evaluable for the effects of Helicobacter pylori eradication on platelet count	1
Arnold et al[81] 2009	Meta-analysis	Meta-analysis of 11 studies, including 282 patients with immune thrombocytopenic purpura who received eradication therapy; 205 were HP+ and 77 HP-	1

Table continued

Table II. (Continued). Papers on the correlation between *Helicobacter pylori* (HP) and diseases of dermatological interest.

Authors, year and reference number	Type of study	Study population	Strength level
Franchini et al[82] 2007	Meta-analysis	Meta-analysis of 17 studies (16 with a prospective cohort design and 1 randomized trial), including 788 patients with immune thrombocytopenic purpura	1
Shaikh et al[83] 2009	Case-control	30 patients with immune thrombocytopenic purpura and 30 healthy controls	8
Wu et al[84] 2009	Open-label	31 patients with immune thrombocytopenic purpura	5
Tag et al[85] 2010	Open-label	25 patients with immune thrombocytopenic purpura	5
Payandeh et al[86] 2012	Open-label	26 patients with immune thrombocytopenic purpura	5
Ferrara et al[87] 2009	Open-label	24 children with immune thrombocytopenic purpura	5
Li et al[88] 2009	RCT	93 HP+ children with immune thrombocytopenic purpura, of which 51 in treatment group (HP eradication + prednisone) and 42 in control group (prednisone)	3
Russo et al[89] 2011	Open-label	244 children with immune thrombocytopenic purpura from 16 centers	5
Tang et al[90] 2013	RCT	92 children with immune thrombocytopenic purpura and 66 healthy controls	3
Tsumoto et al[91] 2009	Prospective cohort	30 patients with immune thrombocytopenic purpura	6
Kikuchi et al[92] 2011	Prospective cohort	11 HP+ patients with immune thrombocytopenic purpura	6
Lichen planus			
Daudén et al[97] 2000	Open-label	10 patients with lichen planus	5
Vainio et al[98] 2000	Case-control	78 patients with lichen planus and 39 patients with other skin diseases	8
Attia et al[99] 2010	Case-control	20 patients with erosive and 20 with non-erosive oral lichen planus	8
Taghavi Zenouz et al[100] 2010	Case-control	30 patients with cutaneous lichen planus, 30 patients with oral lichen planus and 30 healthy individuals	8
Izol et al[101] 2010	Case-control	49 lichen planus patients and 35 volunteers (without lichen planus) with gastrointestinal symptoms	8
Pourshahidi et al[102] 2012	Case-control	41 lichen planus patients and 82 controls	8
Shimoyama et al[103] 2000	Case series	12 cases of recurrent aphthous stomatitis, 7 of herpes simplex virus stomatitis, and 3 of erosive lichen planus	10
Daudén et al[104] 2003	Case-control	14 lichen planus patients, of which 6 with only cutaneous lesions, 3 with exclusively mucosal lesions, and 5 with cutaneous and mucosal lesions; 26 HP+ controls with non-ulcer dyspepsia	8
Atopic dermatitis			
Murakami et al[106] 1996	Case report	A 14-year girl with atopic dermatitis and Helicobacter pylori infection	11
Corrado et al[107] 2000	Case-control	30 patients with atopic dermatitis as the sole clinical manifestation of food allergy, 30 patients affected by food allergy with gastrointestinal symptoms, 30 with atopic asthma	8
Galadari and Sheriff[108] 2006	Case-control	20 patients with chronic idiopathic urticaria, 20 with atopic dermatitis and 20 healthy controls	8
Herbarth et al[109] 2007	Cross-sectional	3347 school starters	9
Shiotani et al[110] 2008	Cross-sectional	1953 university students	9
Amberbir et al[111] 2014	Cohort, prospective	863 children followed up to 5 years of age	6

Table continued

Table II. (Continued). Papers on the correlation between *Helicobacter pylori* (HP) and diseases of dermatological interest.

Authors, year and reference number	Type of study	Study population	Strength level
Holster et al[112] 2012	Cohort, prospective	545 children	6
Recurrent aphthous stomatitis			
Porter et al[114] 1997	Case-control	75 patients with recurrent aphthous ulcers, 15 with other oral ulcerative disorders, 41 with other oral mucosal lesions, 27 with oral dysaesthesia, and 25 healthy controls without oral lesions	8
Maleki et al[115] 2009	Case-control	43 patients with recurrent aphthous stomatitis and 44 healthy controls	8
Shimoyama et al[103] 2000	Case series	12 cases of recurrent aphthous stomatitis, 7 of herpes simplex virus stomatitis, and 3 of erosive lichen planus	10
Birek et al[116] 1999	Case-control	45 patients with oral aphthous ulcers	8
Elsheikh and Mahfouz[117] 2005	Case-control	146 patients with recurrent multiple aphthous ulcers of oral cavity and pharynx and 20 healthy controls	8
Long et al[118] 2007	Case-control	82 patients with recurrent aphthous ulcers and 74 healthy volunteers	8
Riggio et al[119] 2000	Case-control	28 patients with recurrent aphthous ulcers, 20 with oral lichen planus and 13 healthy controls	8
Victória et al[120] 2003	Case-control	36 consecutive patients with minor and major forms of oral lichen planus and 48 healthy volunteers	8
Iamaroon et al[121] 2003	Case-control	22 patients with recurrent aphthous ulcers and 15 healthy individuals	8
Fritscher et al[122] 2004	Case-control	105 children and adolescents, of which 53 patients with recurrent aphthous stomatitis and 52 subjects without lesions (control group)	8
Mansour-Ghanaei et al[123] 2005	Case series	50 patients with recurrent aphthous stomatitis	10
Richter et al[124] 2003	Open-label	28 patients with recurrent aphthous stomatitis	5
Albanidou-Farmaki et al[125] 2005	Open-label	48 patients, of which 34 HP+ and 14 HP- (used as controls)	5
Brailo et al[126] 2007	Case series	68 patients with recurrent aphthous ulcerations	10
Karaca et al[127] 2008	Open-label	23 patients with recurrent aphthous stomatitis	5
Taş et al[128] 2013	Open-label	46 patients with minor aphthous lesions	5
Systemic sclerosis			
Reinauer et al[130] 1994	Open-label	12 patients with systemic sclerosis	5
Yazawa et al[131] 1998	Case-control	124 patients with systemic sclerosis (67 with limited and 57 with diffuse cutaneous systemic sclerosis); 50 healthy individuals as controls	8
Farina et al[132] 2001	Case series	46 patients with systemic sclerosis	10
Yamaguchi et al[133] 2008	Case-control	64 patients with scleroderma	8
Radić et al[134] 2010	Case series	42 patients with systemic sclerosis	10
Radić et al[135] 2010	Systematic review		2
Radić et al[136] 2011	Systematic review		2
Radić et al[137] 2013	Case-control	42 patients with systemic sclerosis and no dyspeptic symptoms, of which 26 HP+, 16 HP-	8
Bilgin et al[138] 2015	Case-control	30 patients with systemic sclerosis and 30 healthy controls	8

Table continued

Table II. (Continued). Papers on the correlation between *Helicobacter pylori* (HP) and diseases of dermatological interest.

Authors, year and reference numbe	Type of study	Study population	Strength level
Psoriasis			
Halasz[144] 1996	Case series	33 patients with psoriasis	10
Fabrizi et al[145] 2001	Case-control	20 patients with psoriasis and 29 controls without skin disorders	8
Daudén et al[146] 2004	Case-control	11 HP+ psoriatic patients, 22 HP+ patients with non-ulcer dyspepsia as controls	8
Qayoom and Ahmad[147] 2003	Case-control	50 patients with psoriasis and 50 healthy individuals as controls	8
Azizzadeh et al[148] 2014	Case-control	61 patients with psoriasis and 61 healthy individuals as controls	8
Sáez-Rodríguez et al[149] 2002	Case report	1 patient with palmoplantar pustulosis in association with chronic gastritis with Helicobacter pylori infection	11
Ali and Whitehead[150] 2008	Case report	1 HP+ patient with chronic epigastric pain and psoriasis	11
Martin Hübner and Tenbaum[151] 2008	Case report	1 HP+ patient with dyspepsia and palmoplantar psoriasis	11
Onsun et al[152] 2012	Open-label, randomized, controlled	300 patients with psoriasis and 150 non-psoriatic healthy controls. Of 50 HP+ psoriatic patients, 25 were randomly assigned to acitretin+HP eradication therapy, 25 to acitretin only.	5
Campanati et al[153] 2015	Open-label	210 patients with psoriasis and 150 non-psoriatic healthy controls. All psoriatic patients underwent phototherapy, HP+ patients also HP eradication therapy	5
Mesquita et al[154] 2017	Case-control	111 patients with psoriasis, 21 healthy volunteers as controls	8
Sjögren's syndrome			
Sugaya et al[158] 1995	Case series	Unspecified number of patients with Sjögren's syndrome	9
Showji et al[159] 1996	Case-control	7 patients with Sjögren's syndrome, 15 with systemic lupus erythematosus, 14 with rheumatoid arthritis, 11 with progressive systemic sclerosis, 16 with polymyositis/dermatomyositis, 12 with mixed connective tissue disease and 19 healthy volunteers as controls.	8
El Miedany et al[160] 2005	Case-control	36 patients with primary Sjögren's syndrome, 31 patients with secondary Sjögren's syndrome, 46 patients with various connective tissue diseases not suffering from sicca symptoms, and 64 healthy controls.	8
Aragona et al[161] 1999	Case-control	34 patients with primary Sjögren's syndrome, 19 patients with secondary Sjögren's syndrome, 22 patients with various autoimmune diseases and 43 healthy controls	8
Theander et al[162] 2001	Case-control	164 patients with Sjögren's syndrome	8
Sorrentino et al[163] 2004	Open-label	54 patients with dyspepsia and Sjögren's syndrome, 150 controls with dyspepsia only.	5
Behçet's disease			
Avci et al[165] 1999	Open-label	69 patients with Behçet's disease	5
Apan et al[165] 2007	Open-label	91 patients with Behçet's disease and 83 controls with or without any gastrointestinal complaints	5
Ersoy et al[166] 2007	Open-label	45 patients with Behçet's disease and 40 controls	5
Cakmak et al[167] 2009	Case-control	40 consecutive patients with Behçet's disease and 40 controls with tinea pedis	8

Table continued

Table II. (Continued). Papers on the correlation between *Helicobacter pylori* (HP) and diseases of dermatological interest.

Authors, year and reference numbe	Type of study	Study population	Strength leve
Lankarani et al[168] 2014	Case-control	48 patients with Behçet's disease and 48 healthy controls	8
Pruritus			
Shiotani et al[17] 2001	Open-label	88 HP+ patients with skin diseases, of which 29 with pruritus cutaneus	5
Sakurane et al[18] 2002	Open-label	198 patients with skin diseases resistant to conventional therapies, of which 32 with pruritus cutaneous	5
Kandyil et al[171] 2002	Open-label	10 patients with severe pruritus unresponsive to conventional therapy	5
Alopecia areata			
Tosti et al[173] 1997	Case-control	68 patients with alopecia areata	8
Rigopoulos et al[174] 2002	Case-control	30 patients with alopecia areata and 30 healthy volunteers	8
Abdel-Hafez et al[175] 2009	Case-control	31 patients with alopecia areata and 24 healthy volunteers	8
Campuzano-Maya[176] 2011	Case report	1 HP+ patient with alopecia areata and dyspepsia	11
Behrangi et al[177] 2017	Case-control	81 patients with alopecia areata and 81 healthy volunteers	8
Lee et al[178] 2019	Meta-analysis	Meta-analysis of 3 studies including 142 patients with alopecia areata and 135 healthy controls	1
Primary cutaneous marginal zone B-cell lymphomas			
Guitart et al[184] 2014	Case-control	80 sequential patients with primary cutaneous marginal zone B-cell lymphoma and 80 controls	8
Vitiligo			
Doğan Z et al[186] 2014	Case-control	68 patients with vitiligo and 65 with telogen effluvium	8
Rifaioğlu EN et al[187] 2014	Case-control	34 patients with vitiligo and 30 healthy controls	8
Pemphigus vulgaris			
Mortazavi H et al[188] 2015	Case-control	82 newly diagnosed and untreated patients with pemphigus vulgaris, 36 patients previously diagnosed with pemphigus vulgaris and treated with immunosuppressive drugs, 131 healthy controls	8
Prurigo nodularis			
Neri et al[190] 1999	Open-label	42 patients with prurigo nodularis	5
Chronic prurigo multiformis			
Shiotani et al[17] 2001	Open-label	88 HP+ patients with skin diseases, of which 10 with prurigo chronica multiformis	5
Sakurane et al[18] 2002	Open-label	198 patients with skin diseases resistant to conventional therapies, of which 17 with prurigo chronica multiformis	5
Akashi et al[33] 2011	Open-label	82 patients with chronic urticaria and 17 with prurigo chronica multiformis	5
Eczema nummulare			
Shiotani et al[17] 2001	Open-label	88 HP+ patients with skin diseases, of which 11 with eczema nummulare	5
Lugovic-Mihic et al[28] 2019	Case-control	123 patients with eczema nummulare and 30 controls with psoriasis vulgaris	8

Table continued

Table II. (Continued). Papers on the correlation between *Helicobacter pylori* (HP) and diseases of dermatological interest.

Authors, year and reference numbe	Type of study	Study population	Strength leve
Prurigo pigmentosa			
Erbagci[191] 2002	Case report	1 HP+ patient with prurigo pigmentosa	11
Missall et al[192] 2012	Case report	1 HP+ patient with prurigo pigmentosa	11
Leukocytoclastic vasculitis			
Herranz et al[193] 1998	Case report	1 HP+ patient with leukocytoclastic vasculitis	11
Lozano Gutiérrez et al[193] 1999	Case report	1 HP+ patient with leukocytoclastic vasculitis	11
Primary cutaneous MALT-type lymphoma			
Mandekou-Lefaki et al[195] 2006	Case report	2 HP+ patients with primary cutaneous MALT-type lymphoma	11
Sublamina densa-type linear IgA bullous dermatosis			
Matsuo et al[196] 2009	Case report	1 HP+ patient with sublamina densa-type linear IgA bullous dermatosis	11
Sweet's syndrome			
Kürkçüoğlu and Aksoy[199] 1997	Case report	1 HP+ patient with Sweet's syndrome	11
Cutaneous T cell pseudolymphoma			
Mitani et al[201] 2006	Case report	1 HP+ patient with cutaneous T cell pseudolymphoma	11

Gray and white background are used for articles in favor and against such association, respectively. Light gray background is used for articles suggesting inverse correlation between HP infection and disease (i.e., protective effect of the infection). The strength level of each article is defined according to the parameters shown in Table I.

nally, Rojo-Gutierrez et al[35] did not found any *Hp*-positive subject in a personal cohort of 35 patients diagnosed with CIU.

Therefore, the involvement of Hp in CU pathogenesis is still on debate, as Minciullo et al[36] clearly highlighted in their recent review of the literature on this topic.

Trying to clarify the pathogenetic mechanism, Tan et al[37] evaluated the direct activation effects of *Hp* preparations and its protein components on the human LAD2 mast cell line *in vitro*. They found out that a 21-35 kDa mixed protein component might be the most probable pathogenic factor. In their study, the authors detected the serum-specific anti-*Hp* IgG and IgE antibodies in 211 CIU and 137 normal subjects by enzyme-linked immunosorbent assay (ELISA). The positive rate of anti-*Hp* IgG positive rate in CIU patients was significantly higher than that in controls, while no statistically significant differences were highlighted regarding anti-*Hp* IgE levels.

Further studies are needed to finally clarify if there is a real cause-effect correlation between *Hp* and chronic urticaria.

Rosacea

Rosacea is a common, chronic inflammatory disease mainly involving the cheek, nose, chin and forehead, which pathogenesis is still unclarified[38]. The possible correlation between Hp-infection and rosacea is the second most studied and debated among skin disorders[39].

For a long time, any link between Hp and rosacea was denied[40-44]. However, this correlation emerged with more and more evidence during the last two decades. Szlachcic et al[45] and Boixeda de Miquel et al[46] showed that rosacea is strictly related to gastritis, mainly with an antral localization, and that *Hp* expresses the Cytotoxin-associated gene A (CagA) in the majority of patients and that *Hp* eradication dramatically improves rosacea signs. Also, Diaz et al[47] found that 13C-UBT and ELISA tests to diagnose *Hp*-infection are more frequently positive in patients with an inflammatory papulopustular rosacea than in patients with a non-inflammatory erythematous-telangiectatic one. Argenziano et al[48] investigated the presence of serum *Hp*-antibodies in patients affected with rosacea. They found specific IgG in 81% of

patients with concurrent dyspepsia, and specific IgA in 62% of the patients of the same group. Anti-CagA antibodies were found in 75% of the patients. Among patients with no gastrointestinal symptoms, IgG was found in 16% and IgA in 6% of them. Other studies[49-52] highlighted a high prevalence of *Hp* infection in patients affected by rosacea, also showing a significant rate of improvement of symptoms after eradication, which lasted for months after the intervention.

On the other hand, in a large-scale prevalence study, Egeberg et al[53], showed a low rate of *Hp* infection in 49,475 patients diagnosed with rosacea in Denmark between 2008 and 2012 (3.3%). This rate was not significantly different from the 2.4% observed in a control population. In addition, Utaş et al[54] compared the seroprevalence of *Hp* in 25 patients with rosacea and 87 age- and sex-matched healthy controls. They did not find any statistically significant difference between the two groups. However, they showed that rosacea significantly improved in *Hp*-positive patients after eradication. Moreover, in a population of 50 dark-skinned Saudi female patients with rosacea, Al Balbeesi and Halawani[55] found that the 22% resulted positive to the UBT, with no correlation to any of the disease subtypes. In this study, the eradication of *Hp* had no significant effect on cutaneous manifestations. In addition, a recent meta-analysis by Jorgensen et al[56] concluded that the association between *Hp*-infection and rosacea should be considered weak, as well as the efficacy of anti-*Hp* therapy on cutaneous signs and symptoms, although a pathogenic role of *Hp*, directly or as a proxy for other factors, cannot be excluded and remains to be elucidated.

In a systematic review about rosacea treatment, Parodi et al[57] suggested testing patients for *Hp* infection and using antibiotic protocols to achieve complete clearance of the condition. Moreover, a clinical trial performed in Iran tried to evaluate the effect of *Hp* standard eradication protocol on the rosacea clinical course[58]. One-hundred sixty-seven patients with active clinical features of rosacea out of 872 patients tested positive for *Hp* infection (19.15%). One-hundred fifty underwent eradicating therapy, showing a 92% cure rate.

Up to date, the pathogenic mechanisms at the basis of rosacea remain unclear. Although many hypotheses have been proposed, its etiology remains unknown[59]. Holmes[60] highlighted that no mechanism explaining how *Hp* gut infection translates to the clinical manifestation of rosacea was yet provided.

Lewinska and Wnuk[61] argued that *Hp* cytotoxin CagA expression induces cellular senescence of human gastric epithelial cells, thus leading to gastrointestinal diseases and systemic inflammation. They hypothesized that chronic skin diseases may be promoted by stress-induced premature senescence of skin cells, such as fibroblasts and keratinocytes, stimulated with *Hp* cytotoxins. This model may generally explain the role of *Hp* not only in rosacea and need to be further studied.

Interestingly, acne vulgaris and rosacea share some of their pathogenetic pathways. In has been highlighted a possible correlation between acne vulgaris and Hp infection. In particular, Saleh et al[62] reported that patients with severe acne vulgaris show a high prevalence and high titer of Hp fecal antigen and serum Hp antibodies and that this titer positively correlates with the severity and duration of the disease.

Henoch-Schönlein Purpura

Henoch-Schönlein Purpura (HSP) is the most common vasculitis of childhood and affects the small blood vessels. Increased inflammation in HSP may play a role as a trigger for the development of some diseases[63-65]. Literature for the association between HSP and *Hp* infection is mostly episodic, consisting in case-reports published since 1995[66-73].

Of particular importance, a meta-analysis by Xiong et al[74] included 10 studies, accounting for a total of 749 Chinese patients and 560 controls. The authors highlighted a statistically significant association between Henoch-Schönlein purpura and *Hp* infection and noticed a lower recurrence rate of cutaneous symptoms on a part of the sample (4 studies, 286 patients). With regard to adults, such association has been reported by Novák et al[75] on a cohort of 11 patients and 20 controls.

Idiopathic Thrombocytopenic Purpura

Immune thrombocytopenic purpura (ITP), otherwise known as idiopathic thrombocytopenic purpura, is defined as isolated thrombocytopenia (platelet count < 100,000/μL) with normal white blood cells and normal hemoglobin in the setting of a generalized purpuric rash. Primary ITP presents without a secondary cause or underlying disorder, whereas secondary ITP is usually drug-induced or systemic illness-induced (systemic lupus erythematosus, HIV, psoriasis, etc.)[76-79].

A striking evidence of the link between ITP and *Hp* infection comes from the systematic review performed by Stasi et al[80]. As a result of the

analysis of 25 studies involving a total of 1555 patients, the authors revealed that platelet count was significantly increased after *Hp* eradication.

Accordingly, the meta-analysis performed by Arnold et al[81] aimed to evaluate differences in platelet response after eradication therapy between *Hp*-positive and *Hp*-negative patients with ITP. They collected 11 studies, accounting for a total of 282 patients, of which 205 *Hp*-positive and 77 *Hp*-negative. Data showed odds of achieving a platelet count response being 14.5-fold higher in the first group after *Hp* eradication. These data were subsequently confirmed by Franchini et al[82], in a meta-analysis including 17 studies for a total of 788 patients. Later studies performed on adults[83-86] and children[87-90] yielded comparable results. Two papers, including follow-up visits at seven[91] and eight[92] years, demonstrated that the effects of *Hp* eradication on platelet count are sustained in the long-term. Based on available evidence, the European Helicobacter Study Group recommends eradication of *Hp* in infected patients with ITP[93].

Lichen Planus

Lichen planus (LP) is an inflammatory disorder of the skin and the mucous membranes of unknown origin. Pathogenesis is thought to be related to a T-cell-mediated autoimmune disease. The prevailing theory is that the exposure to an exogenous agent, such as a virus, drug, or contact allergen causes alteration of epidermal self-antigens and activation of cytotoxic CD8+ T cells[94-96].

Daudén et al[97] were the first to suppose a link between *Hp* and LP, showing partial remission of cutaneous manifestations in 3 out of 10 patients who received eradication therapy against *Hp*. However, skin lesions worsened in 3 other subjects. Later studies, including a total of 198 patients with cutaneous manifestations of lichen planus and 73 with both erosive and non-erosive oral lichen planus, failed to demonstrate an association with *Hp* infection[98-103]. In addition, eradication treatment was ineffective on cutaneous or oral diseases. Even Daudén et al[104] in 2003, reported that CagA seropositivity is not significantly correlated with lichen planus.

Atopic Dermatitis

Atopic dermatitis (AD) is a chronically relapsing inflammatory skin disease resulting from the interaction of genetic, immunological, and environmental factors[105].

The first report about the possible relationship between *Hp* and AD is signed by Murakami et al[106]. In 1996 they published a case of AD improvement following *Hp* eradication. Four years later, Corrado et al[107] studied anti-Hp and anti-CagA IgG titer in children with AD, reporting a correlation between *Hp* antibodies and AD. In 2006, Galadari and Sheriff[108] indirectly confirmed these results also showing a statistically significant correlation between AD and the presence of positive UBT and high titers of anti-*Hp* IgG antibodies.

Subsequent researches showed opposite results, with the authors suggesting that *Hp* infection is inversely associated with atopic dermatitis. Among these, Herbarth et al[109] and Shiotani et al[110]. Amberbir et al[111] revealed the association of *Hp* infection with a decreased risk of eczema between ages 3 and 5 and skin sensitization at age 5. They proposed that the immune modulation towards Th1 response by *Hp* through its protein HP-NAP (*Hp* neutrophil-activating protein), as a possible explanation. However, some further reports confirm that the matter is still in debate. In this setting, Holster et al[112] showed a borderline significantly lower *Hp* seropositivity in wheezers compared to non-wheezers, with no reported association between *Hp* serum antibody status and AD.

Recurrent Aphthous Stomatitis

Recurrent aphthous stomatitis is a chronic inflammatory disease of the oral mucosa characterized by painful mouth ulcers of unknown origin[113]. The relationship between *Hp* and recurrent aphthous stomatitis is quite controversial. Studies[114,115] demonstrated that serum IgG antibodies and UBT results are not significantly different between patients and controls. Shimoyama et al[103] looked for *Hp* in the lesional tissue through cultures from specimens of oral mucosa of affected patients, and their conclusions were against a possible correlation of *Hp* infection and recurrent aphthous stomatitis. Birek et al[116], Elsheikh et al[117] and Long et al[118] used PCR to detect *Hp* DNA on tissue samples, yielding significantly positive results. On the other hand, no significant correlation was noted in the papers by Riggio et al[119], Victória et al[120], Iamaroon et al[121], Fritscher et al[122] and Mansour-Ghanaei et al[123]. However, all papers agreed on the improvement of recurrent aphthous stomatitis after *Hp* eradication, thus confirming a pathogenic connection[124-128].

Systemic Sclerosis

Systemic sclerosis is an autoimmune disease characterized by generalized excessive extracellular matrix deposition and fibrosis of the con-

nective tissue involving the skin and other organs. Pathogenesis remains not fully explained, although infectious agents have been called into question as etiologic agents[129].

Hp infection has been initially thought more as a consequence than a cause of systemic sclerosis, because of peristaltic abnormalities[130]. Yazawa et al[131] supposed that *Hp* could have a causative role in the development of esophageal dysfunction in patients with systemic sclerosis. The following studies[132-138] supported the theory of *Hp* gastric infection linked with systemic sclerosis, thus admitting molecular mimicry as the trigger of autoimmunity. However, a clear relationship has not been established.

Psoriasis

Psoriasis is a multifactorial, chronic autoimmune skin disorder, characterized by several comorbidities[139-143]. As genetic, environmental and lifestyle factors are considered additive, many infections were postulated as possible triggers, although evidence is scarce. A triggering role for *Hp* was suggested in an uncontrolled study by Halasz on 33 patients[144]. Thereafter, small case series reporting contrasting results were published in the medical literature. Concerns on the relationship between *Hp* infection and psoriasis still exist, and serological findings have not clarified the matter[144-148]. Some authors[149-151] reported remission of psoriasis after *Hp* eradication therapy. Moreover, Onsul et al[152] conclude in the biggest study on this topic that there is a relationship between *Hp* infection and psoriasis severity. In addition, they highlight that Hp eradication improves the effectiveness of psoriasis treatment. Accordingly, Campanati et al[153] showed that the prevalence of *Hp* was not significantly different between psoriasis patients and controls. Interestingly, *Hp*-positive patients had more severe psoriasis, which improved after eradication therapy. Mesquita et al[154] showed that the prevalence of anti-Hp antibodies is significantly higher in psoriatic patients than in healthy controls ($p = 0.02$). Moreover, it is significantly associated with disease severity. Thus, they concluded that *Hp* can be a trigger of psoriasis and also a possible marker of severity.

Sjögren's Syndrome

Sjögren's syndrome (SS) ranges from only exocrine gland involvement to a systemic, multiorgan autoimmune disease. It can be classified as either primary SS or secondary SS, with the latter being accompanied by other diseases, such as systemic lupus erythematosus and rheumatoid arthritis. Malignant lymphoproliferation can be considered part of the syndrome[155-157].

Sugaya et al[158] revealed high frequency rates of atrophic gastritis in the presence of *Hp* infection and high levels of *Hp*-specific IgG antibodies, thus concluding that the bacterial infection sustained gastric mucosal injury due to gastric parietal cell antibodies. The following studies seemed to corroborate this idea[159,160]. Experimental data by Aragona et al[161] suggested the possible pathogenic role of the bacterial 60 KDa heat shock protein, while other authors reported a lack of correlation[39,162,163].

Behçet's Disease

Behçet's disease (BD) is a condition characterized by multi-systemic, chronic, inflammatory vasculitis, with a complicated and unclear etiology[39]. The literature search for *Hp* positivity in esophagogastroduodenoscopies or urea breath tests showed no real differences between patients with BD and controls[164-167]. A single paper reported opposite conclusions[168]. However, a significantly higher frequency of CagA positivity in the serum of patients with Behçet's disease was seen by Apan and co-workers[165]. Further data analyses from the above-mentioned studies were in favor of a causal link between Behçet's disease and *Hp*, as they demonstrated the improvement of the condition, in terms of oral and genital ulcerations, arthritis/arthralgia and other cutaneous manifestations after bacterial eradication therapy[164,165].

Pruritus

Itch is an extremely frequent and enervating symptom of many diseases[169]. Several studies show that this symptom is the result of a complex interplay among skin, nervous, endocrine, and immune system[170].

The relationship between *Hp* and pruritus was evaluated on few cases, as a sub-analysis of studies about various cutaneous diseases. Shiotani et al[17] noticed partial remission of pruritus in 62% of 29 patients after anti-*Hp* treatment; similar rates (58%) were achieved on smaller cohort by Sakurane et al[18], while Kandyil et al[171] reported complete relief of in 5/8 patients and partial relief in 2. Anyway, these data are too limited to draw any conclusion.

Alopecia Areata

Alopecia areata (AA) is a complex autoimmune condition that causes nonscarring hair loss.

It presents with well demarcated round patches of hair at any age[172]. AA is associated with various systemic and psychiatric disorders. A review of the literature on the association with *Hp* infection yielded no conclusive information. Tosti et al[173] reported higher seroprevalence of *Hp* in 68 alopecia areata patients than in controls. Successive studies did not confirm such data[174,175]. Campuzano-Maya[176] reported a single case of remission of alopecia areata after *Hp* eradication. More recently, a case-control study on the Iranian population revealed positive UBT in 43 (53.1%) patients in cases and 27 (33.3%) individuals in control group. Therefore, it was highlighted a statistically significant ($p = 0.011$) role of *Hp* contamination in the physiopathology of alopecia areata[177]. Finally, Lee et al[178] in 2019 systematically reviewed the medical literature for comorbidities in alopecia areata. Among several other diseases, they reported patients with AA (a total of 142 patients *vs.* 135 healthy controls) having higher odds of Helicobacter pylori infection (OR, 2.03; 95% CI,1.23-3.34; prevalence, 62.8%)

Primary Cutaneous Marginal Zone B-cell Lymphomas

One-fourth of primary cutaneous lymphomas are B-cell derived and are classified into three distinct subgroups: primary cutaneous follicle center lymphoma (PCFCL), primary cutaneous marginal zone lymphoma (PCMZL), and primary cutaneous diffuse large B-cell lymphoma, leg type (PCDLBCL, LT)[179]. Lymphomas are also classified in Hodgkin's and non-Hodgkin's[180-183].

A single case-control study evaluated the possible relationship between PCMZL and several conditions, including *Hp* infection[184]: 16/80 patients *vs.* 2/80 matched healthy controls had positive *Hp* serology ($p = 0.003$). While this difference seemed to suggest a correlation, a robust evidence is still lacking.

Vitiligo

Vitiligo is a chronic inflammatory skin disease leading to the loss of epidermal melanocytes, still characterized by unexplained etiopathology and several comorbidities[185]. With regard to the possible links with *Hp* infection, Dogan et al[186] compared the rate of positivity to UBT, *Hp* IgG and CagA in 68 vitiligo patients and 65 subjects with telogen effluvium, showing significantly ($p < 0.05$) higher values in the first group. Moreover, dyspepsia was noticed as significantly more frequent among vitiligo patients. No correlation was found with the Vitiligo Disease Activity (VDA) score or the type of vitiligo. Similar results and conclusions were revealed in another study performed on a Turkish population, using only UBT as a diagnostic criterion for *Hp* infection[187].

Pemphigus Vulgaris

Pemphigus vulgaris (PV) is an autoimmune disease clinically characterized by blisters occurring on cutaneous and mucosal surfaces, that has been firstly linked with *Hp* in the late 2015. Mortazavi et al[188] compared the rates of seropositivity for various infectious agents, including *Strongyloides stercoralis*, *Helicobacter pylori*, *Toxoplasma gondii*, *Leishmania major*, and Epstein-Barr virus, in 82 newly diagnosed and untreated patients with pemphigus vulgaris, 36 subjects previously diagnosed with the same disease and treated with immunosuppressive drugs, and 131 healthy controls. Positivity for *Hp* and *Strongyloides stercoralis* was significantly more frequent ($p = 0.004$) in untreated pemphigus vulgaris patients than in controls, while no significant differences were found when considering the other microbes investigated. To the best of our knowledge, this study remains unique in literature.

Prurigo Nodularis

Prurigo nodularis is the most severe degree of chronic prurigo, presenting with multiple nodules commonly located on the extensor surfaces of the extremities associated with skin excoriations due to an intense pruritus. Whatever the etiology, prurigo nodularis is autonomous disease which is related to itch sensitization[189].

Correlation of *Hp* infection with prurigo nodularis has been suggested by Neri et al[190] through a study on 42 patients, of whom 40 were found positive for *Hp* infection. Among them, the authors reported a significant improvement of cutaneous signs and symptoms after bacterial eradication in 39 subjects.

Miscellaneous

Many other associations between *Hp* and cutaneous diseases have been reported or only hypothesized on the basis of single case-experiences or small case-series.

Chronic prurigos other than nodularis type have been cited is some studies including a wide variety of diseases[17,18,31]. Shiotani et al[17] also recommend being aware of *Hp*, and thus testing, in patients with eczema nummulare. In this setting, Lugovic-Mihic et al[28] reports that nummular ec-

zema patients had significantly higher positive *Hp* findings ($p = 0.046$). Moreover, two case reports[191-194] claim a possible correlation between *Hp* and prurigo pigmentosa leukocytoclastic vasculitis, and between *Hp* and leukocytoclastic vasculitis. Two additional cases[195-201] deal with the association between *Hp* infection and primary cutaneous MALT-type lymphoma, and single cases for which concerns sublamina densa-type linear IgA bullous dermatosis, Sweet's syndrome and cutaneous T cell pseudo lymphoma. Finally, two additional papers[202-206] also hypothesize the possible expression of melanoma differentiation associated genes with Hp infection in gastric mucosa, but relationship with cutaneous involvement is still unrevealed.

Conclusions

The mystery of *Hp* beyond the gastrointestinal apparatus and related diseases remains unsolved and fascinating for researchers.

Particularly, the link between *Hp* and skin has been largely evoked, even in common cutaneous conditions. Whereas some data, both experimental and based on clinical experiences, seem to support intriguing correlations, the total of available studies do not provide unequivocal evidence of a role of this bacterium in the pathogenesis of selected skin disorders.

Larger study populations, assessed by randomized controlled trials and meta-analyses, are needed, to better define the possible mechanisms underlying cutaneous manifestations in course of *Hp* colonization. The growing attention to the topic by interdisciplinary teams of scientists is promising.

Conflict of Interest

The Authors declare that they have no conflict of interests.

References

1) Bizzozero G. Ueber die schlauchförmigen Drüsen des Magendarmkanals und die Beziehungen ihres Epitheles zu dem Oberflächenepithel der Schleimhaut. Archiv für mikroskopische Anatomie 1893; 42: 82-152.
2) Marshall BJ, Warren JR. Unidentified curved bacilli in the stomach of patients with gastritis and peptic ulceration. Lancet 1984; 1: 1311-1315.
3) Wang W-L, Xu X-J. Correlation between Helicobacter pylori infection and Crohn's disease: a meta-analysis. Eur Rev Med Pharmacol Sci 2019; 23: 10509-10516.
4) Gasbarrini G, Bonvicini F. Interaction between Helicobacter pylori and human gastric mucosa revisited by electron microscopy: still something new to debate? Eur Rev Med Pharmacol Sci 2018; 22: 5312-5316.
5) McColl KE. Clinical practice. Helicobacter pylori infection. N Engl J Med 2010; 362: 1597-1604.
6) Uemura N, Okamoto S, Yamamoto S, Matsumura N, Yamaguchi S, Yamakido M, Taniyama K, Sasaki N, Schlemper RJ. Helicobacter pylori infection and the development of gastric cancer. N Engl J Med 2001; 345: 784-789.
7) Tan HJ, Goh KL. Extragastrointestinal manifestations of Helicobacter pylori infection: facts or myth? A critical review. J Dig Dis 2012; 13: 342-349.
8) Suzuki H, Franceschi F, Nishizawa T, Gasbarrini A. Extragastric manifestations of Helicobacter pylori infection. Helicobacter 2011; 16: 65-69.
9) Hernando-Harder AC, Booken N, Goerdt S, Singer MV, Harder H. Helicobacter pylori infection and dermatologic diseases. Eur J Dermatol 2009; 19: 431-444.
10) Kountouras J, Zavos C, Chatzopoulos D. A concept on the role of Helicobacter pylori infection in autoimmune pancreatitis. J Cell Mol Med 2005; 9: 196-207.
11) Guarneri F, Guarneri C, Benvenga S. Helicobacter pylori and autoimmune pancreatitis: role of carbonic anhydrase via molecular mimicry? J Cell Mol Med 2005; 9: 741-744.
12) Guarneri F, Guarneri C, Cannavò SP. Oral iron therapy and chronic idiopathic urticaria: sideropenic urticaria? Dermatol Ther 2014; 27: 223-226
13) Varga L, Löcsei Z, Döbrönte Z, Lakatos F, Brózik M, Merétey K. Helicobacter pylori allergy. Orv Hetil 1992; 133: 359-361.
14) Rebora A, Drago F, Parodi A. May Helicobacter pylori be important for dermatologists? Dermatology 1995; 191: 6-8.
15) Kalas D, Prónai L, Ferenczi K, Pálos G, Daróczy J. Connection between Helicobacter pylori infection and chronic gastrointestinal urticaria. Orv Hetil 1996; 137: 1969-1972.¬¬¬¬
16) Di Campli C, Gasbarrini A, Nucera E, Franceschi F, Ojetti V, Sanz Torre E, Schiavino D, Pola P, Patriarca G, Gasbarrini G. Beneficial effects of Helicobacter pylori eradication on idiopathic chronic urticaria. Dig Dis Sci 1998; 43: 1226-1229.
17) Shiotani A, Okada K, Yanaoka K, Itoh H, Nishioka S, Sakurane M, Matsunaka M. Beneficial effect of Helicobacter pylori eradication in dermatologic diseases. Helicobacter 2001; 6: 60-65.
18) Sakurane M, Shiotani A, Furukawa F. Therapeutic effects of antibacterial treatment for intractable skin diseases in Helicobacter pylori-positive Japanese patients. J Dermatol 2002; 29: 23-27.
19) Yadav MK, Rishi JP, Nijawan S. Chronic urticaria and Helicobacter pylori. Indian J Med Sci 2008; 62: 157-162.
20) Dennis MF, Mavura DR, Kini L, Philemon R, Masenga EJ. Association between chronic urticaria and Helicobacter pylori infection among patients attending a tertiary hospital in Tanzania. Dermatol Res Pract 2020; 2020: 5932038.

21) Fukuda S, Shimoyama T, Umegaki N, Mikami T, Nakano H, Munakata A. Effect of Helicobacter pylori eradication in the treatment of Japanese patients with chronic idiopathic urticaria. J Gastroenterol 2004; 39: 827-830.
22) Wedi B, Wagner S, Werfel T, Manns MP, Kapp A. Prevalence of Helicobacter pylori-associated gastritis in chronic urticaria. Int Arch Allergy Immunol 1998; 116: 288-294.
23) Wustlich S, Brehler R, Luger TA, Pohle T, Domschke W, Foerster E. Helicobacter pylori as a possible bacterial focus of chronic urticaria. Dermatology 1999; 198: 130-132.
24) Magen E, Mishal J, Schlesinger M, Scharf S. Eradication of Helicobacter pylori infection equally improves chronic urticaria with positive and negative autologous serum skin test. Helicobacter 2007; 12: 567-571.
25) Başkan EB, Türker T, Gülten M, Tunali S. Lack of correlation between Helicobacter pylori infection and autologous serum skin test in chronic idiopathic urticaria. Int J Dermatol 2005; 44: 993-995.
26) Sun L, Erxun K, Li J, Yang J, Han C. Correlations between anti-mast cell autoantibodies and chronic idiopathic urticaria. Ann Dermatol 2014; 26: 145-149.
27) Moreira A, Rodrigues J, Delgado L, Fonseca J, Vaz M. Is Helicobacter pylori infection associated with chronic idiopathic urticaria? Allergol Immunopathol (Madr) 2003; 31: 209-214.
28) Lugović-Mihić L, Bukvić I, Bulat V, Japundžić I. Factors contributing to chronic urticaria/angioedema and nummular eczema resolution--Which findings are crucial? Acta Clin Croat 2019; 58: 595-603.
29) Valsecchi R, Pigatto P. Chronic urticaria and Helicobacter pylori. Acta Derm Venereol 1998; 78: 440-442.
30) Daudén E, Jiménez-Alonso I, García-Díez A. Helicobacter pylori and idiopathic chronic urticaria. Int J Dermatol 2000; 39: 446-452.
31) Sianturi GN, Soebaryo RW, Zubier F, Syam AF. Helicobacter pylori infection: prevalence in chronic urticaria patients and incidence of autoimmune urticaria (study in Dr. Cipto Mangunkusumo Hospital, Jakarta). Acta Med Indones 2007; 39: 157-162.
32) Schnyder B, Helbling A, Pichler WJ. Chronic idiopathic urticaria: natural course and association with Helicobacter pylori infection. Int Arch Allergy Immunol 1999; 119: 60-63.
33) Akashi R, Ishiguro N, Shimizu S, Kawashima M. Clinical study of the relationship between Helicobacter pylori and chronic urticaria and prurigo chronica multiformis: effectiveness of eradication therapy for Helicobacter pylori. J Dermatol 2011; 38: 761-766.
34) Rojo-Gutiérrez MI, Flores-Ruvalcaba CN, Mellado-Ábrego J, Castillo-Narváez G, Ramírez-Rojo DP. Usefulness of studies looking for autoimmunity in patients with spontaneous chronic urticaria. Rev Alerg Mex. 2015; 62: 175-181.
35) Magen E, Schlesinger M, Hadari I. Chronic urticaria can be triggered by eradication of Helicobacter pylori. Helicobacter 2013; 18: 83-87.
36) Minciullo PL, Cascio A, Barberi G, Gangemi S. Urticaria and bacterial infections. Allergy Asthma Proc 2014; 35: 295-302.
37) Tan RJ, Sun HQ, Zhang W, Yuan HM, Li B, Yan HT, Lan CH, Yang J, Zhao Z, Wu JJ, Wu C. A 21-35 kDa mixed protein component from helicobacter pylori activates mast cells effectively in chronic spontaneous urticaria. Helicobacter 2016; 21: 565-574.
38) van Zuuren EJ. Rosacea. N Engl J Med 2017; 377: 1754-1764.
39) Guarneri C, Lotti J, Fioranelli M, Roccia MG, Lotti T, Guarneri F. Possible role of Helicobacter pylori in diseases of dermatological interest. J Biol Regul Homeost Agents 2017; 31: 57-77.
40) Jones MP, Knable AL Jr, White MJ, Durning SJ. Helicobacter pylori in rosacea: lack of an association. Arch Dermatol 1998; 134: 511.
41) Sharma VK, Lynn A, Kaminski M, Vasudeva R, Howden CW. A study of the prevalence of Helicobacter pylori infection and other markers of upper gastrointestinal tract disease in patients with rosacea. Am J Gastroenterol 1998; 93: 220-222.
42) Bamford JT, Tilden RL, Blankush JL, Gangeness DE. Effect of treatment of Helicobacter pylori infection on rosacea. Arch Dermatol 1999; 135: 659-663.
43) Herr H, You CH. Relationship between Helicobacter pylori and rosacea: it may be a myth. J Korean Med Sci 2000; 15: 551-554.
44) Hernández Ceruelos A, Romero-Quezada LC, Ruvalcaba Ledezma JC, López Contreras L. Therapeutic uses of metronidazole and its side effects: an update. Eur Rev Med Pharmacol Sci 2019; 23: 397:401
45) Szlachcic A, Sliwowski Z, Karczewska E, BielaÐski W, Pytko-Polonczyk J, Konturek SJ. Helicobacter pylori and its eradication in rosacea. J Physiol Pharmacol 1999; 50: 777-786.
46) Boixeda de Miquel D, Vázquez Romero M, Vázquez Seoueiros E, Foruny Olcina JR, Boixeda de Miquel P, López San Román A, Alemán Villanueva S, Martín de Argila de Prados C. Effect of Helicobacter pylori eradication therapy in rosacea patients. Rev Esp Enferm Dig 2006; 98: 501-509.
47) Diaz C, O'Callaghan CJ, Khan A, Ilchyshyn A. Rosacea: a cutaneous marker of Helicobacter pylori infection? Results of a pilot study. Acta Derm Venereol 2003; 83: 282-286.
48) Argenziano G, Donnarumma G, Iovene MR, Arnese P, Baldassarre MA, Baroni A. Incidence of anti-Helicobacter pylori and anti-CagA antibodies in rosacea patients. Int J Dermatol 2003; 42: 601-604.
49) Gravina AG, Federico A, Ruocco E, Lo Schiavo A, Masarone M, Tuccillo C, Peccerillo F, Miranda A, Romano L, de Sio C, de Sio I, Persico M, Ruocco V, Riegler G, Loguercio C, Romano M. Helicobacter pylori infection but not small intestinal bacterial overgrowth may play a pathogenic role in rosacea. United European Gastroenterol J 2015; 3: 17-24.
50) Agnoletti AF, De Col E, Parodi A, Schiavetti I, Savarino V, Rebora A, Paolino S, Cozzani E, Drago F. Etiopathogenesis of rosacea: a prospective study with a three-year follow-up. G Ital Dermatol Venereol 2016. In press.
51) Mayr-Kanhäuser S, Kränke B, Kaddu S, Müllegger RR. Resolution of granulomatous rosacea after eradication of Helicobacter pylori with clarithromycin, metronidazole and pantoprazole. Eur J Gastroenterol Hepatol 2001; 13: 1379-1383.

52) Daković Z, Vesić S, Vuković J, Milenković S, Janković-Terzić K, Dukić S, Pavlović MD. Ocular rosacea and treatment of symptomatic Helicobacter pylori infection: a case series. Acta Dermatovenerol Alp Panonica Adriat 2007; 16: 83-86.
53) Egeberg A, Weinstock LB, Thyssen EP, Gislason GH, Thyssen JP. Rosacea and gastrointestinal disorders: a population-based cohort study. Br J Dermatol 2017; 176: 100-6.
54) Utaş S, Ozbakir O, Turasan A, UtaÐ C. Helicobacter pylori eradication treatment reduces the severity of rosacea. J Am Acad Dermatol 1999; 40: 433-435.
55) Al Balbeesi AO, Halawani MR. Unusual features of rosacea in Saudi females with dark skin. Ochsner J 2014; 14: 321-327.
56) Jørgensen AR, Egeberg A, Gideonsson R, Weinstock LB, Thyssen EP, Thyssen JP. Rosacea is associated with Helicobacter pylori: a systematic review and meta-analysis. J Eur Acad Dermatol Venereol 2017; 31: 2010-2015.
57) Parodi A, Drago F, Paolino S, Cozzani E, Gallo R. Treatment of rosacea. Ann Dermatol Venereol 2011; 138: S211-S214.
58) Saleh P, Naghavi-Behzad M, Herizchi H, Mokhtari F, Mirza-Aghazadeh-Attari M, Piri R. Effects of Helicobacter pylori treatment on rosacea: a single-arm clinical trial study. J Dermatol 2017; 44: 1033-1037.
59) Lazaridou E, Korfitis C, Kemanetzi C, Sotiriou E, Apalla Z, Vakirlis E, Fotiadou C, Lallas A, Ioannides D. Rosacea and Helicobacter pylori: links and risks. Clin Cosmet Investig Dermatol 2017; 10: 305-310.
60) Holmes AD. Potential role of microorganisms in the pathogenesis of rosacea. J Am Acad Dermatol 2013; 69: 1025-1032.
61) Lewinska A, Wnuk M. Helicobacter pylori-induced premature senescence of extragastric cells may contribute to chronic skin diseases. Biogerontology 2017; 18: 293-299.
62) Saleh R, Sedky Mahmoud A, Moustafa DA, Abu El-Hamd M. High levels of Helicobacter pylori antigens and antibodies in patients with severe acne vulgaris. J Cosmet Dermatol 2020 Apr 25. doi: 10.1111/jocd.13409. Online ahead of print.
63) Akamine K, Punaro M. Biologics for childhood systemic vasculitis. Pediatr Nephrol 2019; 34: 2295-2309.
64) Di Lernia V, Guarneri C, Stingeni L, Gisondi P, Bonamonte D, Calzavara Pinton PG, Offidani A, Hansel K, Girolomoni G, Filoni A, Belloni Fortina A, Ficarelli E, Cannavò SP. Effectiveness of etanercept in children with plaque psoriasis in real practice: a one-year multicenter retrospective study. J Dermatol Treat 2018; 29: 217-219.
65) Di Lernia V, Bonamonte D, Lasagni C, Belloni Fortina A, Cambiaghi S, Corazza M, Di Nuzzo S, Gisondi P, Panzone M, Guarneri C, Neri I. Effectiveness and safety of acitretin in children with plaque psoriasis: a multicenter retrospective analysis. Ped Dermatol 2016; 33: 530-535.
66) Reinauer S, Megahed M, Goerz G, Ruzicka T, Borchard F, Susanto F, Reinauer H. Schönlein-Henoch purpura associated with gastric Helicobacter pylori infection. J Am Acad Dermatol 1995; 33: 876-879.
67) Mozrzymas R, d'Amore ES, Montini G, Guariso G. Schönlein-Henoch vasculitis and chronic Helicobacter pylori associated gastritis and duodenal ulcer: a case report. Pediatr Med Chir 1997; 19: 467-468.
68) Machet L, Vaillant L, Machet MC, Büchler M, Lorette G. Schönlein-Henoch purpura associated with gastric Helicobacter pylori infection. Dermatology 1997; 194: 86.
69) Cecchi R, Torelli E. Schönlein-Henoch purpura in association with duodenal ulcer and gastric Helicobacter pylori infection. J Dermatol 1998; 25: 482-484.
70) Grivceva-Panovska V, Grivceva Stardelova K, Serafimoski V. Henoch-Schönlein purpura in an adult patient: extragastric, cutaneous manifestation of Helicobacter pylori infection. Prilozi 2008; 29: 291-301.
71) Mytinger JR, Patterson JW, Thibault ES, Webb J, Saulsbury FT. Henoch-Schönlein purpura associated with Helicobacter pylori infection in a child. Pediatr Dermatol 2008; 25: 630-632.
72) Hoshino C. Adult onset Schönlein-Henoch purpura associated with Helicobacter pylori infection. Intern Med 2009; 48: 847-851.
73) Ulas T, Tursun I, Dal MS, Eren MA, Buyukhatipoglu H. Rapid improvement of Henoch-Schonlein purpura associated with the treatment of Helicobacter pylori infection. J Res Med Sci 2012; 17: 1086-1088.
74) Xiong LJ, Tong Y, Wang ZL, Mao M. Is Helicobacter pylori infection associated with Henoch-Schonlein purpura in Chinese children? a meta-analysis. World J Pediatr 2012; 8: 301-308.
75) Novák J, Szekanecz Z, Sebesi J, Takáts A, Demeter P, Bene L, Sipka S, Csiki Z. Elevated levels of anti-Helicobacter pylori antibodies in Henoch-Schönlein purpura. Autoimmunity 2003; 36: 307-311.
76) John ML, Scharrer I. Autoimmune disorders in patients with idiopathic thrombotic thrombocytopenic purpura. Hamostaseologie 2012; 32 Suppl 1: S86-S89.
77) Ceccarelli M, Venanzi Rullo E, Vaccaro M, Facciolà A, d'Aleo F, Paolucci IA, Cannavò SP, Cacopardo B, Pinzone MR, Pellicanò GF, Condorelli F, Nunnari G, Guarneri C. HIV-associated psoriasis: epidemiology, pathogenesis, and management. Dermatol Ther 2019; 32: e12806.
78) Guarneri C, Tchernev G, Bevelacqua V, Lotti T, Nunnari G. The unwelcome trio: HIV plus cutaneous and visceral leishmaniasis. Dermatol Ther 2016; 29: 88-91.
79) Wang R, Cao Q, Bai S-T, Wang L, Sheng G-Y. Potential role and mechanism for high mobility group box1 in childhood chronic immune thrombocytopenia. Eur Rev Med Pharmacol Sci 2019; 23: 10931-10941
80) Stasi R, Sarpatwari A, Segal JB, Osborn J, Evangelista ML, Cooper N, Provan D, Newland A, Amadori S, Bussel JB. Effects of eradication of Helicobacter pylori infection in patients with immune thrombocytopenic purpura: a systematic review. Blood 2009; 113: 1231-1240.
81) Arnold DM, Bernotas A, Nazi I, Stasi R, Kuwana M, Liu Y, Kelton JG, Crowther MA. Platelet count re-

sponse to H. pylori treatment in patients with immune thrombocytopenic purpura with and without H. pylori infection: a systematic review. Haematol 2009; 94: 850-856.
82) Franchini M, Cruciani M, Mengoli C, Pizzolo G, Veneri D. Effect of Helicobacter pylori eradication on platelet count in idiopathic thrombocytopenic purpura: a systematic review and meta-analysis. J Antimicrob Chemother 2007; 60: 237-246.
83) Shaikh KH, Ahmed S, Ayyub M, Anwar J. Association of Helicobacter pylori infection with idiopathic thrombocytopenic purpura. J Pak Med Assoc 2009; 59: 660-663.
84) Wu S, Li Y, Jian Z, Tang F. Anti-Helicobacter pylori treatment in patients with idiopathic thrombocytopenic purpura. Zhong Nan Da Xue Xue Bao Yi Xue Ban 2009; 34: 1251-1254.
85) Tag HS, Lee HS, Jung SH, Kim BK, Kim SB, Lee A, Lee JS, Shin SH, Kim YS. Effects of Helicobacter pylori eradication in patients with immune thrombocytopenic purpura. Korean J Hematol 2010; 45: 127-132.
86) Payandeh M, Sohrabi N, Zare ME, Kansestani AN, Hashemian AH. Platelet count response to Helicobacter pylori eradication in Iranian patients with idiopathic thrombocytopenic purpura. Mediterr J Hematol Infect Dis 2012; 4: e2012056.
87) Ferrara M, Capozzi L, Russo R. Effect of Helicobacter pylori eradication on platelet count in children with chronic idiopathic thrombocytopenic purpura. Hematology 2009; 14: 282-285.
88) Li CX, Liu DJ, Pan CQ, Sang XF, Li X. Effect of Helicobacter pylori eradication on childhood acute idiopathic thrombocytopenic purpura. Nan Fang Yi Ke Da Xue Xue Bao 2009; 29: 1243-1244.
89) Russo G, Miraglia V, Branciforte F, Matarese SMR, Zecca M, Bisogno G, Parodi E, Amendola G, Giordano P, Jankovic M, Corti A, Nardi M, Farruggia P, Battisti L, Baronci C, Palazzi G, Tucci F, Ceppi S, Nobili B, Ramenghi U, De Mattia D, Notarangelo L, AIEOP-ITP Study Group. Effect of eradication of Helicobacter pylori in children with chronic immune thrombocytopenia: a prospective, controlled, multicenter study. Pediatr Blood Cancer 2011; 56: 273-278.
90) Tang Y, Wang SC, Wang LJ, Liu Y, Wang HY, Wang ZJ. Clinical significance of Helicobacter pylori in children with idiopathic thrombocytopenic purpura. Zhongguo Shi Yan Xue Ye Xue Za Zhi 2013; 21: 419-421.
91) Tsumoto C, Tominaga K, Okazaki H, Tanigawa T, Yamagami H, Watanabe K, Nakao T, Koh K, Watanabe T, Fujiwara Y, Yamane T, Oshitani N, Hino M, Higuchi K, Arakawa T. Long-term efficacy of Helicobacter pylori eradication in patients with idiopathic thrombocytopenic purpura: 7-year follow-up prospective study. Ann Hematol 2009; 88: 789-793.
92) Kikuchi T, Kobayashi T, Yamashita T, Ohashi K, Sakamaki H, Akiyama H. Eight-year follow-up of patients with immune thrombocytopenic purpura related to H. pylori infection. Platelets 2011; 22: 61-64.
93) Malfertheiner P, Megraud F, O'Morain C, Bazzoli F, El-Omar E, Graham D, Hunt R, Rokkas T, Vakil N, Kuipers EJ. Current concepts in the management of Helicobacter pylori infection: the Maastricht III Consensus Report. Gut 2007; 56: 772-781.
94) Arnold DL, Krishnamurthy K. Lichen Planus. StatPearls [Internet]. StatPearls Publishing, 2020.
95) Guarneri F, Guarneri C, Marini H. Oral lichen planus and neurogenic inflammation: new observations and therapeutic implications from four clinical cases. Dermatol Ther 2014; 27: 206-210.
96) Guarneri F, Guarneri C, Cannavò SP. An unusual case of cell phone dermatitis. Contact Dermatitis 2010; 62: 117.
97) Daudén E, Vázquez-Carrasco MA, Peñas PF, Pajares JM, García-Díez A. Association of Helicobacter pylori infection with psoriasis and lichen planus: prevalence and effect of eradication therapy. Arch Dermatol 2000; 136: 1275-1276.
98) Vainio E, Huovinen S, Liutu M, Uksila J, Leino R. Peptic ulcer and Helicobacter pylori in patients with lichen planus. Acta Derm Venereol 2000; 80: 427-429.
99) Attia EA, Abdel Fattah NS, Abdella HM. Upper gastrointestinal findings and detection of Helicobacter pylori in patients with oral lichen planus. Clin Exp Dermatol 2010; 35: 355-360.
100) Taghavi Zenouz A, Mehdipour M, Jafari Heydarlou M, Gholizadeh N. Relationship between lichen planus and Helicobacter pylori infection. J Dent Res Dent Clin Dent Prospects 2010; 4: 17-20.
101) Izol B, Karabulut AA, Biyikoglu I, Gonultas M, Eksioglu M. Investigation of upper gastrointestinal tract involvement and H. pylori presence in lichen planus: a case-controlled study with endoscopic and histopathological findings. Int J Dermatol 2010; 49: 1121-1126.
102) Pourshahidi S, Fakhri F, Ebrahimi H, Fakhraei B, Alipour A, Ghapanchi J, Farjadian S. Lack of association between Helicobacter pylori infection and oral lichen planus. Asian Pac J Cancer Prev 2012; 13: 1745-1747.
103) Shimoyama T, Horie N, Kato T, Kaneko T, Komiyama K. Helicobacter pylori in oral ulcerations. J Oral Sci 2000; 42: 225-229.
104) Daudén E, Cabrera MM, Oñate MJ, Pajares JM, García-Díez A. Helicobacter pylori CagA seropositivity is not strongly associated with lichen planus. J Am Acad Dermatol 2003; 49: 1199.
105) Guarneri F, Costa C, Foti C, Hansel K, Guarneri C, Guarneri B, Lisi P, Stingeni L. Frequency of autoallergy to manganese superoxide dismutase in patients with atopic dermatitis: experience of three Italian dermatology centres. Br J Dermatol 2015; 173: 559-562.
106) Murakami K, Fujioka T, Nishizono A, Nagai J, Tokieda M, Kodama R, Kubota T, Nasu M. Atopic dermatitis successfully treated by eradication of Helicobacter pylori. J Gastroenterol 1996; 31: 77-82.
107) Corrado G, Luzzi I, Pacchiarotti C, Lucarelli S, Frediani T, Cavaliere M, Rea P, Cardi E. Helicobacter pylori seropositivity in children with atopic dermatitis as sole manifestation of food allergy. Pediatr Allergy Immunol 2000; 11: 101-105.
108) Galadari IH, Sheriff MO. The role of Helicobacter pylori in urticaria and atopic dermatitis. Skinmed 2006; 5: 172-176.
109) Herbarth O, Bauer M, Fritz GJ, Herbarth P, Rolle-Kampczyk U, Krumbiegel P, Richter M, Richter T. Helicobacter pylori colonisation and eczema. J Epidemiol Community Health 2007; 61: 638-640.

110) Shiotani A, Miyanishi T, Kamada T, Haruma K. Helicobacter pylori infection and allergic diseases: epidemiological study in Japanese university students. J Gastroenterol Hepatol 2008; 23: e29-e33.
111) Amberbir A, Medhin G, Abegaz WE, Hanlon C, Robinson K, Fogarty A, Britton J, Venn A, Davey G. Exposure to Helicobacter pylori infection in early childhood and the risk of allergic disease and atopic sensitization: a longitudinal birth cohort study. Clin Exp Allergy 2014; 44: 563-571.
112) Holster IL, Vila AM, Caudri D, den Hoed CM, Perez-Perez GI, Blaser MJ, de Jongste JC, Kuipers EJ. The impact of Helicobacter pylori on atopic disorders in childhood. Helicobacter 2012; 17: 232-237.
113) Sánchez-Bernal J, Conejero C, Conejero R. Recurrent aphthous stomatitis. Actas Dermosifiliogr 2020; 111: 471-480.
114) Porter SR, Barker GR, Scully C, Macfarlane G, Bain L. Serum IgG antibodies to Helicobacter pylori in patients with recurrent aphthous stomatitis and other oral disorders. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1997; 83: 325-328.
115) Maleki Z, Sayyari AA, Alavi K, Sayyari L, Baharvand M. A study of the relationship between Helicobacter pylori and recurrent aphthous stomatitis using a urea breath test. J Contemp Dent Pract 2009; 10: 9-16.
116) Birek C, Grandhi R, McNeill K, Singer D, Ficarra G, Bowden G. Detection of Helicobacter pylori in oral aphthous ulcers. J Oral Pathol Med 1999; 28: 197-203.
117) Elsheikh MN, Mahfouz ME. Prevalence of Helicobacter pylori DNA in recurrent aphthous ulcerations in mucosa-associated lymphoid tissues of the pharynx. Arch Otolaryngol Head Neck Surg 2005; 131: 804-808.
118) Long BJ, Chen K, Wu BL, Duan JM. Detection of Helicobacter pylori in oral cavity of patients with recurrent aphthous ulcer. Nan Fang Yi Ke Da Xue Xue Bao 2007; 27: 477-478.
119) Riggio MP, Lennon A, Wray D. Detection of Helicobacter pylori DNA in recurrent aphthous stomatitis tissue by PCR. J Oral Pathol Med 2000; 29: 507-513.
120) Victória JM, Kalapothakis E, Silva Jde F, Gomez RS. Helicobacter pylori DNA in recurrent aphthous stomatitis. J Oral Pathol Med 2003; 32: 219-223.
121) Iamaroon A, Chaimano S, Linpisarn S, Pongsiriwet S, Phornphutkul K. Detection of Helicobacter pylori in recurrent aphthous ulceration by nested PCR. J Oral Sci 2003; 45: 107-110.
122) Fritscher AM, Cherubini K, Chies J, Dias AC. Association between Helicobacter pylori and recurrent aphthous stomatitis in children and adolescents. J Oral Pathol Med 2004; 33: 129-132.
123) Mansour-Ghanaei F, Asmar M, Bagherzadeh AH, Ekbataninezhad S. Helicobacter pylori infection in oral lesions of patients with recurrent aphthous stomatitis. Med Sci Monit 2005; 11: CR576-CR579.
124) Richter J, Grimmová M, Stiborová I, Král V, Jílek D. Detection of Helicobacter pylori in the saliva of patients with recurrent aphthous stomatitis. Cas Lek Cesk 2003; 142: 665-669.
125) Albanidou-Farmaki E, Giannoulis L, Markopoulos A, Fotiades S, Aggouridaki X, Farmakis K, Papanayotou P. Outcome following treatment for Helicobacter pylori in patients with recurrent aphthous stomatitis. Oral Dis 2005; 11: 22-26.
126) Brailo V, Boras VV, Cekić-Arambasin A. Recurrent aphthous ulcerations: analysis of predisposing factors in 68 patients. Lijec Vjesn 2007; 129: 4-7.
127) Karaca S, Seyhan M, Senol M, Harputluoglu MM, Ozcan A. The effect of gastric Helicobacter pylori eradication on recurrent aphthous stomatitis. Int J Dermatol 2008; 47: 615-617.
128) Taş DA, Yakar T, Sakalli H, Serin E. Impact of Helicobacter pylori on the clinical course of recurrent aphthous stomatitis. J Oral Pathol Med 2013; 42: 89-94.
129) Polimeni G, Esposito E, Bevelacqua V, Guarneri C, Cuzzocrea S. Role of melatonin supplementation in neurodegenerative disorders. Front Biosci (Landmark Ed) 2014; 19: 429-446.
130) Reinauer S, Goerz G, Ruzicka T, Susanto F, Humfeld S, Reinauer H. Helicobacter pylori in patients with systemic sclerosis: detection with the 13C-urea breath test and eradication. Acta Derm Venereol 1994; 74: 361-363.
131) Yazawa N, Fujimoto M, Kikuchi K, Kubo M, Ihn H, Sato S, Tamaki T, Tamaki K. High seroprevalence of Helicobacter pylori infection in patients with systemic sclerosis: association with esophageal involvement. J Rheumatol 1998; 25: 650-653.
132) Farina G, Rosato E, Francia C, Proietti M, Donato G, Ammendolea C, Pisarri S, Salsano F. High incidence of Helicobacter pylori infection in patients with systemic sclerosis: association with Sicca Syndrome. Int J Immunopathol Pharmacol 2001; 14: 81-85.
133) Yamaguchi K, Iwakiri R, Hara M, Kikkawa A, Fujise T, Ootani H, Shimoda R, Tsunada S, Sakata H, Ushiyama O, Koarada S, Tada Y, Nagasawa K, Fujimoto. Reflux esophagitis and Helicobacter pylori infection in patients with scleroderma. Intern Med 2008; 47: 1555-1559.
134) Radić M, Martinović Kaliterna D, Bonacin D, Morović Vergles J, Radić J. Correlation between Helicobacter pylori infection and systemic sclerosis activity. Rheumatology (Oxford) 2010; 49: 1784-1785.
135) Radić M, Martinović Kaliterna D, Radić J. Infectious disease as aetiological factor in the pathogenesis of systemic sclerosis. Neth J Med 2010; 68: 348-353.
136) Radić M, Kaliterna DM, Radić J. Helicobacter pylori infection and systemic sclerosis-is there a link? Joint Bone Spine 2011; 78: 337-340.
137) Radić M, Kaliterna DM, Bonacin D, Morović Vergles J, Radić J, Fabijanić D, Kovačić. Is Helicobacter pylori infection a risk factor for disease severity in systemic sclerosis? Rheumatol Int 2013; 33: 2943-2948.
138) Bilgin H, KocabaĐ H, KeĐli R. The prevalence of infectious agents in patients with systemic sclerosis. Turk J Med Sci 2015; 45: 1192-1197.
139) Dattilo G, Imbalzano E, Casale M, Guarneri C, Borgia F, Mondello S, Laganà P, Romano P, Oreto G, Cannavò S. Psoriasis and cardiovascular risk: correlation between psoriasis and cardiovascular functional indices. Angiology 2018; 69: 31-37.

140) Dattilo G, Borgia F, Guarneri C, Casale M, Bitto R, Morabito C, Signorelli S, Katsiki N, Cannavò SP. Cardiovascular risk in psoriasis: current state of the art. Curr Vasc Pharmacol 2019; 17: 85-91.
141) Borgia F, Ciodaro F, Guarneri F, Bartolotta A, Papaianni V, Guarneri C, Catalano N, Galletti F, Cannavò SP. Auditory system involvement in psoriasis. Acta Derm Venereol 2018; 98: 655-659.
142) Zuccotti E, Oliveri M, Girometta C, Ratto D, Di Iorio C, Occhinegro A, Rossi P. Nutritional strategies for psoriasis: current evidence in clinical trials. Eur Rev Med Pharmacol Sci 2018; 22: 8537-8551
143) Li SS, Liu Y, Wang LP, Xue LF, Yin GS, Wu XS. Identification of psoriasis vulgaris biomarkers in human plasma by non-targeted metabolomics based on UPLC-Q-TOF/MF. Eur Rev Med Pharmacol Sci 2019; 23: 3940-3950.
144) Halasz CL. Helicobacter pylori antibodies in patients with psoriasis. Arch Dermatol 1996; 132: 95-96.
145) Fabrizi G, Carbone A, Lippi ME, Anti M, Gasbarrini G. Lack of evidence of relationship between Helicobacter pylori infection and psoriasis in childhood. Arch Dermatol 2001; 137: 1529.
146) Daudén E, Cabrera MM, Oñate MJ, Pajares JM, García-Díez A. CagA seropositivity in Helicobacter pylori positive patients with psoriasis. J Eur Acad Dermatol Venereol 2004; 18: 116-117.
147) Qayoom S, Ahmad QM. Psoriasis and Helicobacter pylori. Indian J Dermatol Venereol Leprol 2003; 69: 133-134.
148) Azizzadeh M, Nejad ZV, Ghorbani R, Pahlevan D. Relationship between Helicobacter pylori infection and psoriasis. Ann Saudi Med 2014; 34: 241-244.
149) Sáez-Rodríguez M, Noda-Cabrera A, García-Bustínduy M, Guimerá-Martín-Neda F, Dorta-Alom S, Escoda-García M, Fagundo-González E, Sánchez-González R, Rodríguez-García F, García-Montelongo R. Palmoplantar pustulosis associated with gastric Helicobacter pylori infection. Clin Exp Dermatol 2002; 27: 720.
150) Ali M, Whitehead M. Clearance of chronic psoriasis after eradication therapy for Helicobacter pylori infection. J Eur Acad Dermatol Venereol 2008; 22: 753-754.
151) Martin Hübner A, Tenbaum SP. Complete remission of palmoplantar psoriasis through Helicobacter pylori eradication: a case report. Clin Exp Dermatol 2008; 33: 339-340.
152) Onsun N, Arda Ulusal H, Su O, Beycan I, Biyik Ozkaya D, Senocak M. Impact of Helicobacter pylori infection on severity of psoriasis and response to treatment. Eur J Dermatol 2012; 22: 117-120.
153) Campanati A, Ganzetti G, Martina E, Giannoni M, Gesuita R, Bendia E, Giuliodori K, Sandroni L, Offidani A. Helicobacter pylori infection in psoriasis: results of a clinical study and review of the literature. Int J Dermatol 2015; 54: e109-e114.
154) Mesquita PM, Filho AD, Jorge MT, Berbert AL, Mantese SA, Rodrigues JJ. Relationship of Helicobacter pylori seroprevalence with the occurrence and severity of psoriasis. An Bras Dermatol 2017; 92: 52-57.
155) Igoe A, Merjanah S, Scofield RH. Sjögren syndrome and cancer. Rheum Dis Clin North Am 2020; 46: 513-532.
156) Malaponte G, Hafsi S, Polesel J, Castellano G, Spessotto P, Guarneri C, Canevari S, Signorelli SS, McCubrey JA, Libra M. Tumor microenvironment in diffuse large B-cell lymphoma: Matrixmetalloproteinases activation is mediated by osteopontin overexpression. Biochim Biophys Acta 2016; 1863: 483-489.
157) Malaponte G, Signorelli SS, Bevelacqua V, Polesel J, Taborelli M, Guarneri C, Fenga C, Umezawa K, Libra M. Increased levels of NF-kB-dependent markers in cancer-associated deep venous thrombosis. PLoS One 2015; 10: e0132496.
158) Sugaya T, Sakai H, Sugiyama T, Imai K. Atrophic gastritis in Sjögren's syndrome. Nihon Rinsho 1995; 53: 2540-2544.
159) Showji Y, Nozawa R, Sato K, Suzuki H. Seroprevalence of Helicobacter pylori infection in patients with connective tissue diseases. Microbiol Immunol 1996; 40: 499-503.
160) El Miedany YM, Baddour M, Ahmed I, Fahmy H. Sjogren's syndrome: concomitant H. pylori infection and possible correlation with clinical parameters. Joint Bone Spine 2005; 72: 135-141.
161) Aragona P, Magazzù G, Macchia G, Bartolone S, Di Pasquale G, Vitali C, Ferreri G. Presence of antibodies against Helicobacter pylori and its heat-shock protein 60 in the serum of patients with Sjögren's syndrome. J Rheumatol 1999; 26: 1306-1311.
162) Theander E, Nilsson I, Manthorpe R, Jacobsson LT, Wadström T. Seroprevalence of Helicobacter pylori in primary Sjögren's syndrome. Clin Exp Rheumatol 2001; 19: 633-638.
163) Sorrentino D, Faller G, DeVita S, Avellini C, Labombarda A, Ferraccioli G, Kahlow-Toussaint S. Helicobacter pylori associated antigastric autoantibodies: role in Sjögren's syndrome gastritis. Helicobacter 2004; 9: 46-53.
164) Avci O, Ellidokuz E, Simşek I, Büyükgebiz B, Güneş AT. Helicobacter pylori and Behçet's disease. Dermatology 1999; 199: 140-143.
165) Apan TZ, Gürsel R, Dolgun A. Increased seropositivity of Helicobacter pylori cytotoxin-associated gene-A in Behçet's disease. Clin Rheumatol 2007; 26: 885-889.
166) Ersoy O, Ersoy R, Yayar O, Demirci H, Tatlican S. H. pylori infection in patients with Behcet's disease. World J Gastroenterol 2007; 13: 2983-2985.
167) Cakmak SK, Cakmak A, Gül U, Sulaimanov M, Bingöl P, HazinedaroÐlu MS. Upper gastrointestinal abnormalities and Helicobacter pylori in Behçet's disease. Int J Dermatol 2009; 48: 1174-1176.
168) Lankarani KB, Ravanbod MR, Aflaki E, Nazarinia MA, Rajaee A. High prevalence of Helicobacter pylori infection in Behcet's disease. BMC Gastroenterol 2014; 14: 58.
169) Terranova M, Guarneri C, Guarneri F, Terranova G, Lotti T. Some historical and epistemological remarks on itch and pruritus. Dermatol Ther 2005; 18: 283-287.
170) Guarneri C, Terranova M, Terranova G, Guarneri F. The future: critical knowledge about anti-itch therapy. Dermatol Ther 2005; 18: 363-365.
171) Kandyil R, Satya NS, Swerlick RA. Chronic pruritus associated with Helicobacter pylori. J Cutan Med Surg 2002; 6: 103-108.

172) Darwin E, Hirt PA, Fertig R, Doliner B, Delcanto G, Jimenez JJ. Alopecia areata: review of epidemiology, clinical features, pathogenesis, and new treatment options. Int J Trichology 2018; 10: 51-60.
173) Tosti A, Pretolani S, Figura N, Polini M, Cameli N, Cariani G, Miglio F, Bonvicini F, Baldini L, Gnucci E, Lucente P, Gasbarrini G. Helicobacter pylori and skin diseases. Gastroenterol Int 1997; 10: 37-39.
174) Rigopoulos D, Katsambas A, Karalexis A, Papatheodorou G, Rokkas T. No increased prevalence of Helicobacter pylori in patients with alopecia areata. J Am Acad Dermatol 2002; 46: 141.
175) Abdel-Hafez HZ, Mahran AM, Hofny ER, Attallah DA, Sayed DS, Rashed HA. Is Helicobacter pylori infection associated with alopecia areata? J Cosmet Dermatol 2009; 8: 52-55.
176) Campuzano-Maya G. Cure of alopecia areata after eradication of Helicobacter pylori: a new association? World J Gastroenterol 2011; 17: 3165-3170.
177) Behrangi E, Mansouri P, Agah S, Ebrahimi Daryani N, Mokhtare M, Azizi Z, Ramezani Ghamsari M, Rohani Nasab M, Azizian Z. Association between Helicobacter pylori infection and alopecia areata: a study in Iranian population. Middle East J Dig Dis 2017; 9: 107-110.
178) Lee S, Lee H, Lee CH, Lee WS. Comorbidities in alopecia areata: a systematic review and meta-analysis. J Am Acad Dermatol 2019; 80: 466-477.
179) Hristov AC, Tejasvi T, Wilcox RA. Cutaneous B-cell lymphomas: 2021 update on diagnosis, risk-stratification, and management. Am J Hematol 2020 Aug 20. doi: 10.1002/ajh.25970. Online ahead of print.
180) Spina M, Berretta M, Tirelli U. Hodgkin's disease in HIV. Hematol Oncol Clin North Am 2003; 17: 843-858.
181) Simonelli C, Tedeschi R, Gloghini A, Talamini R, Bortolin MT, Berretta M, Spina M, Morassut S, Vaccher E, De Paoli P, Carbone A, Tirelli U. Plasma HHV-8 viral load in HHV-8 related lymphoproliferative disorders associated with HIV infection. J Med Virol 2009; 81: 888-896.
182) Kalan Farmanfarma K, Heidarpour Kiasara S, Hassanipour S, Salehiniya H. Non-Hodgkin's Lymphoma in the world: an epidemiological review. World Cancer Res J 2020; 7: e1520.
183) Ahmadi F, Abadi AR, Baghestani AR. Trends of Non-Hodgkin Lymphoma cancer death rates with adjusting the effect of the human development index: the global assessment in 1990-2015. World Cancer Res J 2019; 6: e1325.
184) Guitart J, Deonizio J, Bloom T, Martinez-Escale ME, Kuzel TM, Gerami P, Kwasny M, Rosen ST. High incidence of gastrointestinal tract disorders and autoimmunity in primary cutaneous marginal zone B-cell lymphomas. JAMA Dermatol 2014; 150: 412-418.
185) Migayron L, Boniface K, Seneschal J. Vitiligo, from physiopathology to emerging treatments: a review. Dermatol Ther (Heidelb) 2020 Sep 19. doi: 10.1007/s13555-020-00447-y. Online ahead of print.
186) Doğan Z, Özdemir P, Ekşioğlu M, Filik L. Relationship between Helicobacter pylori infection and vitiligo: a prospective study. Am J Clin Dermatol 2014; 15: 457-462.
187) Rifaioğlu EN, Aydoğan F, Bülbül Đen B, Đen T, Ekiz Ö. Investigation into the frequency of Helicobacter pylori infection with carbon 14 urea breath test in patients with vitiligo. Turk J Med Sci 2014; 44: 1051-1054.
188) Mortazavi H, Hejazi P, Khamesipour A, Mohebali M, Hooshang Ehsani A, Mohammadi Y, Vashegani Farahani I, Akbar Amirzargar A. Frequency of seropositivity against infectious agents amongst pemphigus vulgaris patients: a case-control study on Strongyloides stercoralis, Helicobacter pylori, Toxoplasma gondii, Leishmania major, and Epstein-Barr virus. Int J Dermatol 2015; 54: e458-e465.
189) Misery L. Prurigo nodulaire [Prurigo nodularis]. Rev Prat 2020; 70: 187-189.
190) Neri S, Ierna D, D'Amico RA, Giarratano G, Leotta C. Helicobacter pylori and prurigo nodularis. Hepatogastroenterol 1999; 46: 2269-2272.
191) Erbagci Z. Prurigo pigmentosa in association with Helicobacter pylori infection in a Caucasian Turkish woman. Acta Derm Venereol 2002; 82: 302-303.
192) Missall TA, Pruden S, Nelson C, Fohn L, Vidal CI, Hurley MY. Identification of Helicobacter pylori in skin biopsy of prurigo pigmentosa. Am J Dermatopathol 2012; 34: 446-448.
193) Herranz P, Capilla C, Lázaro TE, Casado M. Leukocytoclastic vasculitis associated with Helicobacter pylori infection. Rev Clin Esp 1998; 198: 779.
194) Lozano Gutiérrez F, Rivera Cívico JM, Grilo Reina A, Benítez Domínguez JA. Vasculitis and Helicobacter pylori. Med Clin (Barc) 1999; 113: 359.
195) Mandekou-Lefaki I, Delli FS, Kountouras J, Athanasiou E, Mattheou-Vakali G. Primary cutaneous MALT-type lymphoma and Helicobacter pylori: a possible relationship. J Eur Acad Dermatol Venereol 2006; 20: 606-608.
196) Matsuo A, Tanaka R, Shiotani A, Haruma K, Ishii N, Hashimoto T, Fujimoto W. Remission of sublamina densa-type linear IgA bullous dermatosis after Helicobacter pylori eradication. Clin Exp Dermatol 2009; 34: e988-e399.
197) Guarneri C, Wollina U, Lotti T, Maximov GK, Lozev I, Gianfaldoni S, Pidakev I, Lotti J, Tchernev G. Sweet's Syndrome (SS) in the course of acute myeloid leukaemia (AML). Open Access Maced J Med Sci 2018; 6: 105-107.
198) Polimeni G, Cardillo R, Garaffo E, Giardina C, Macrì R, Sirna V, Guarneri C, Arcoraci V. Allopurinol-induced Sweet's syndrome. Int J Immunopathol Pharmacol 2016; 29: 329-332.
199) Kürkçüoğlu N, Aksoy F. Sweet's syndrome associated with Helicobacter pylori infection. J Am Acad Dermatol 1997; 37: 123-124.
200) Guarneri C, Lentini M, Polimeni G, Giuffrida R, Cannavò SP. Ustekinumab-induced drug eruption resembling lymphocytic infiltration (of Jessner-Kanof) and lupus erythematosus tumidus. Br J Clin Pharmacol 2016; 81: 792-794.
201) Mitani N, Nagatani T, Ikezawa Z, Kakemizu N, Yamakawa Y, Aihara M, Nozawa A, Tomita N, Tanaka K. A case of cutaneous T cell pseudolymphoma in a patient with Helicobacter pylori infection. Dermatology 2006; 213: 156-158.

202) Fukuyama T, Yamazaki T, Fujita T, Uematsu T, Ichiki Y, Kaneko H, Suzuki T, Kobayashi N. Helicobacter pylori, a carcinogen, induces the expression of melanoma antigen-encoding gene (Mage)-A3, a cancer/testis antigen. Tumour Biol 2012; 33: 1881-1887.
203) Bevelacqua V, Bevelacqua Y, Candido S. Nectin like-5 overexpression correlates with the malignant phenotype in cutaneous melanoma. Oncotarget 2012; 3:882-892.
204) Guarneri C, Bevelacqua V, Polesel J, Falzone L, Cannavò PS, Spandidos DA, Malaponte G, Libra M. NF-κB inhibition is associated with OPN/MMP-9 downregulation in cutaneous melanoma. Oncol Rep 2017; 37: 737-746.
205) Skarmoutsou E, Bevelacqua V, D' Amico F, Russo A, Spandidos DA, Scalisi A, Malaponte G, Guarneri C. FOXP3 expression is modulated by TGF-β1/NOTCH1 pathway in human melanoma. Int J Mol Med 2018; 42: 392-404.
206) Tatsuta T, Imaizumi T, Shimoyama T, Sawaya M, Kunikazu T, Matsumiya T, Yoshida H, Satoh K, Fukuda S. Expression of melanoma differentiation associated gene 5 is increased in human gastric mucosa infected with Helicobacter pylori. J Clin Pathol 2012; 65: 839-843.