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MANAGEMENT OF ASTHMA (PART 2)

- **Asthma is the leading cause of childhood morbidity from chronic disease**
- **In children, the management pathway is determined by age of the child and availability of licensed medications for that age group**
- **It is essential to establish the severity of an acute exacerbation of asthma as this determines the treatment pathway**
- **Early follow-up and review of the current management plan is recommended after an acute attack**

INTRODUCTION

Asthma is a major cause of chronic morbidity and mortality throughout the world.[1] Its prevalence is increasing especially among children; it is the leading cause of childhood morbidity from chronic disease as measured by school/day care absences, emergency department (ED) visits and hospitalisations.[2,3] This, the second of 2 bulletins on asthma, will (1) discuss the specific aspects of management of childhood asthma and (2) outline the management of acute exacerbation of asthma in adults and children from the primary care perspective.[4]

DIAGNOSIS OF ASTHMA IN CHILDREN

The Global Initiative for Asthma (GINA), which provides scientific guidance for healthcare professionals on asthma management and prevention, has recommended that the guidance on diagnosis and management of adults with asthma should be used for **children aged 6 years and older**.[5] The diagnostic features of adult asthma are outlined in the recently published NMIC bulletin: Management of Asthma (Part I).[6]

The diagnosis of asthma in **children 5 years and younger** is challenging and has important clinical consequences. The diagnosis is based on clinical judgement, using an assessment of symptoms, family history and physical findings; there is no single test that provides a definitive diagnosis in this age group.[2,7] Other causes of respiratory symptoms in this age group should be excluded such as infection (e.g. recurrent respiratory tract infections, tuberculosis), congenital (e.g. cystic fibrosis, congenital heart disease) and mechanical problems (e.g. foreign body aspiration, gastroesophageal reflux).[2] **Symptoms which are highly suggestive of asthma include frequent episodes of wheeze (> 1 per month), activity-induced cough or wheeze, nocturnal cough in periods without viral infection, absence of seasonal variation in wheeze and symptoms that persist beyond 3 years of age**.[2,3] Not all children who wheeze have asthma; viral respiratory infections are the most common factors responsible for acute wheezing episodes in young children. The diagnosis of asthma is more likely in those children with a strong family history of asthma, and a history of atopy and / or allergic rhinitis.[2] Three categories of wheezing have been described in children ≤ 5 years: (1) **transient early wheezing** which is often associated with prematurity and parental smoking and often outgrown in the first 3 years, (2) **persistent early-onset wheezing** (before 3 years) characterised by recurrent episodes of wheezing associated with acute viral respiratory infection in children who have no evidence of family history of atopy (the symptoms may persist through school age) and (3) **late onset wheezing/asthma** characterised by children who typically have an atopic background and have asthma which often persists throughout childhood into adulthood.[1]

There are a number of **assessments which may be helpful in the diagnosis** including a trial of treatment with a short-acting β_2 agonist (SABA) and inhaled corticosteroid (ICS) for up to 12 weeks; marked clinical improvement during this treatment, and deterioration when it stops, supports a diagnosis of asthma.[2,4] If there is doubt about the diagnosis a chest x-ray may be helpful to exclude other diagnoses. Lung function testing (e.g. peak expiratory flow – PEF) does not have a major role in the diagnosis of asthma in children ≤5 years due to their inability to perform reproducible expiratory manoeuvres.[2]

MANAGEMENT OF ASTHMA IN CHILDREN

The goals of management for all patients with asthma are to achieve control of the clinical manifestations of the disease and to maintain that control for prolonged periods of time.[2] The first component of management is to develop the patient/doctor relationship. **The family and caregivers play a vital role in the management of children with asthma.** Key areas of the management package include education on inhaler technique, use of controller treatments (and importance of adherence to the agreed regimen), agreement of acute asthma management plans, monitoring of side-effects and an emphasis on trying to achieve a normal level of functioning in terms of school attendance and maintenance of normal activity levels including exercise.[4,8]

Non-pharmacological Management

Asthma education should be provided to family members and caregivers as well as to the child with asthma. The purpose of education is to empower the patient and/or parent and promote guided self-management;[2] several studies have shown reductions in asthma morbidity following asthma education programmes.[9] Figure 1 outlines recommended topics for an educational discussion with the child and his/her parent(s) in relation to asthma.

Figure 1: Potential topics for an educational discussion in asthma[9]

- Nature of disease
- Nature of prescribed treatment(s) and how to use them correctly (including adherence)
- Treatment goals: specific areas where child / parent most want treatment to have an effect
- Agreement of asthma management plan in light of treatment goals
- Recognition and management of acute exacerbations
- Appropriate allergen / trigger avoidance

Each child should have an agreed written asthma management plan; this reinforces verbal instructions and should optimise treatment adherence.[9] Asthma management plan templates are available from **www.asthmasociety.ie**.

Environmental control has been evaluated as a method of reducing asthma symptoms.[10] **Smoking cessation** is recommended for parents, and practical advice on how to stop should be given if needed; the risks of smoking should also be discussed with older children and adolescents.[11] There are conflicting views on the usefulness of **house dust mite reduction measures** for children with asthma and it is likely that no single intervention will achieve sufficient benefits to be cost-effective.[1,12] Animal allergens (especially **cat and dog dander**) have been reported to exacerbate asthma symptoms, but there are no controlled trials on the

benefits of removing them from the house.[13] Moreover, even after the removal of the pet from the home, recommended by some guidelines (which may cause emotional distress to the child), it may take many months before the allergen levels decrease, and the child will still be exposed to such allergens since they can be found in many environments outside the home.[1] **Food allergy** as a cause of asthma exacerbation is uncommon, occurring primarily in young children; food avoidance is only recommended if there is clear evidence of specific food allergy.[1] The role of **dietary substances** such as food dyes and preservatives has not been fully elucidated and **dietary manipulation**, in terms of mineral or anti-oxidant supplements, likewise lacks data from controlled studies.[10] However **weight reduction** in obese asthma patients has been shown to improve asthma control.[14]

Pharmacological Management

The treatment schedule for children should be based on the severity of the individual's symptoms. Figure 1 in the companion NMIC bulletin: Management of Asthma (Part I) outlines the various levels of asthma control; the medications currently available to treat asthma are outlined in Tables 3 and 4 of the same bulletin.[6] As noted previously, lung function testing is not feasible as a means of monitoring asthma control in children ≤ 5 years. The Summary of Product Characteristics (SmPC) for each medication should be consulted as not all are authorised for the various age groups and, in addition, doses may differ according to age.

Table 1: Types of preferred inhaler device for children according to age[3]

Age group	Preferred device
< 4 years	Pressurised MDI **plus** dedicated spacer with face mask
4 – 6 years	Pressurised MDI **plus** dedicated spacer with mouthpiece
> 6 years	Pressurised MDI **plus** dedicated spacer with mouthpiece [Dry powder inhaler, or breath-actuated pressurised MDI may be used in children > 8 years]

MDI – metered dose inhaler

Inhaled therapy is the cornerstone of chronic asthma treatment for children of all ages. The choice of inhaler must be individualised to the patient as different age groups require different inhalers for effective therapy.[1,2] Table 1 outlines a strategy for choosing the preferred inhaler device according to age. **Instructional videos on the correct use of inhaler devices commonly used by both children and adults are available** on the Asthma Society website at: www.asthma.ie/get-help/learn-about-asthma/medicines-treatments/video-gallery.

Inhaled short-acting β_2 agonists (SABA) are the **preferred reliever treatment** for asthma in children.[2] Inhaled anticholinergic agents are not recommended in the day-to-day management of asthma in children.[2]

Inhaled corticosteroids (ICS) are the **preferred controller medication** for asthma in children of all ages.[2] In clinical trials, low-dose ICS have not been associated with serious adverse systemic effects; however higher doses (≥ 400 micrograms daily beclometasone or equivalent) may be associated with effects on growth and the hypothalamic-pituitary-adrenal axis.[2,13] **The lowest dose of ICS should be used to maintain control and a child's growth should be monitored annually**.[13] Oral corticosteroids (CS) should be restricted to the treatment of acute severe exacerbations due to the side effects associated with prolonged use.[2]

Long-acting β_2 agonists (LABA) may be used as add-on therapy in children > 5 years whose asthma is not controlled by medium doses of ICS. Studies have shown that single dose LABA is effective at blocking exercise-induced bronchoconstriction for several hours.[2] **The effects of LABAs in children ≤ 5 years have not been adequately studied and cannot be recommended in this age group**.[2,3]

Leukotriene Receptor Antagonists (LTRA) provide clinical benefit in children but with less effect than that of low-dose ICS.[2] They are recommended as add-on therapy when response to low-dose ICS is insufficient.[15] Not all LTRAs are authorised for use in children <12 years of age, therefore, the relevant SmPC should be checked before prescribing.[16,17]

Theophylline has shown some efficacy as monotherapy and as add-on therapy in children > 5 years, however the efficacy is less than that of low-dose ICS and side effects are common, which limits its use.[2,15] There is limited evidence of efficacy in children ≤5 years.[3,15]

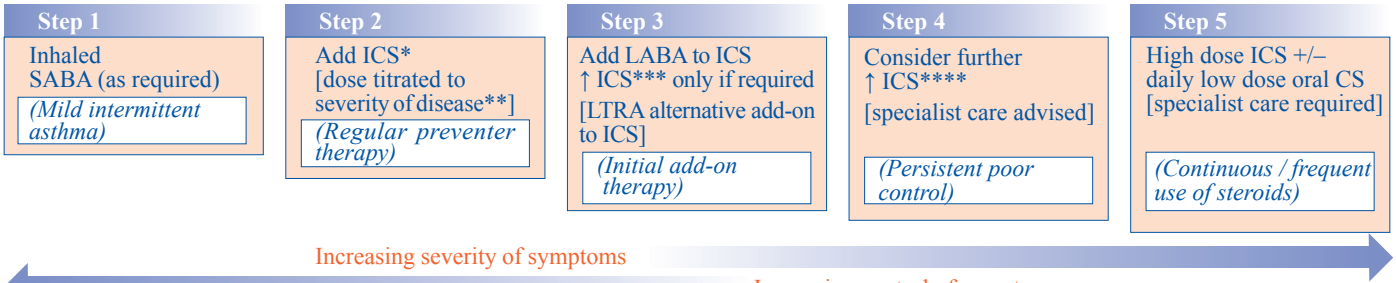
Omalizumab has shown efficacy in children aged 6-12 years with moderate to severe and severe persistent allergic (IgE-mediated) asthma;[18] it should only be initiated by specialists in the management of asthma.

MANAGEMENT OF CHILDHOOD ASTHMA IN CLINICAL PRACTICE

The chronic management of asthma in children involves a stepwise approach until control is achieved, using age-appropriate dosage regimens.[13] Control is assessed using symptoms such as wheezing, cough, difficulty in breathing, limitation of activities, nocturnal symptoms /awakening and the need for reliever/rescue treatment. [See Figure 1: **Levels of Asthma Control** in the companion NMIC bulletin: Management of Asthma (Part I) for further details].

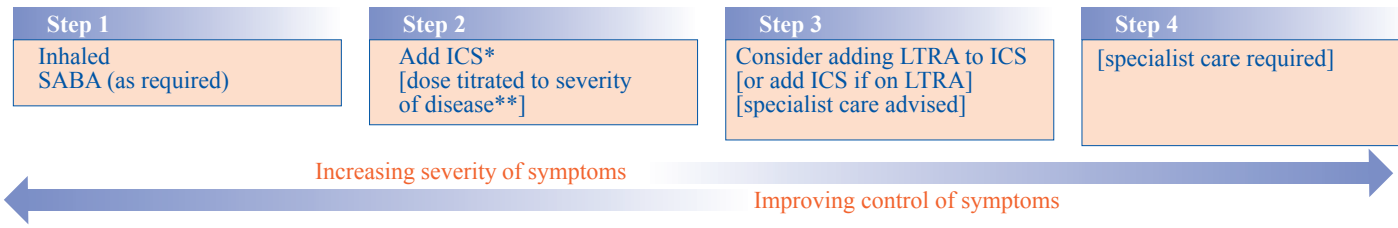
The recommended stepwise management of asthma for children ≥ 6 years is outlined in Figure 2 (below) and Figure 3 outlines the management of asthma for children ≤ 5years.[13]

Figure 2: Stepwise Approach in the Management of Asthma in Children ≥ 6 years[13]



*LTRA may be used if ICS not considered appropriate; **daily dose of 200 micrograms beclometasone dipropionate (BDP) or equivalent is an appropriate starting dose for many patients; *** up to max daily dose of 400 micrograms BDP or equivalent; **** up to max daily dose of 800 micrograms BDP or equivalent.
ICS= inhaled corticosteroids; SABA = short-acting β_2 agonist; LABA = long-acting β_2 agonist; LTRA = leukotriene receptor antagonist

Figure 3: Stepwise Approach in the Management of Asthma in Children ≤ 5 years[13]



*LTRA may be used if ICS not considered appropriate; **recommended daily dose of 200-400 micrograms beclometasone dipropionate or equivalent.
ICS= inhaled corticosteroids; SABA = short-acting β_2 agonist; LTRA = leukotriene receptor antagonist

A low-dose ICS is the recommended preferred initial chronic treatment to control asthma in all children; this should be used for at least 3 months to assess its effectiveness.[3] LTRA may be used as an alternative treatment at this stage, if ICS are not considered appropriate for the individual child.[2] At the end of the 3 months, **if the child's asthma remains uncontrolled, and if the child is found to have the correct inhaler technique and is adherent to treatment, the next step in the management plan should be taken** (see Figures 2 and 3).[3,13] The preferred next step in the management of children whose asthma is not controlled depends on the age of the child; LABAs are not authorised for children ≤ 5 years, therefore options include adding a LTRA in this age group. Treatment regimens should be re-evaluated at each visit and stepped up or down as appropriate. In addition, the need for continued pharmacotherapy of asthma should be regularly assessed (every 3 to 6 months). Asthma symptoms remit in a substantial proportion of children ≥ 5 years and there is a marked seasonal variation.[2]

ACUTE EXACERBATION OF ASTHMA IN ADULTS AND CHILDREN

Acute exacerbations are defined as episodes of progressive increases in shortness of breath, cough, wheezing, or chest tightness or some combination of these symptoms.[1] **It is important to determine if the acute exacerbation of asthma is a severe or life-threatening event**. Mild attacks (reduction in PEF of <20% in adults) may be managed in the home or GP surgery setting; however severe (and some moderate) exacerbations may require care in an emergency department (ED) or hospital setting.[13] **Features associated with high risk of asthma-related death** include: a history of prior near-fatal asthma attack or difficult asthma; emergency treatment within the previous year; current or recent use of oral CS; not using ICS; poor compliance with asthma medications; over-reliance on SABA therapy; concurrent psychosocial problems including the use of sedatives.[1,13]

Diagnosis

In the case of adults and older children, measurement of PEF is the most reliable way of evaluating the degree of bronchoconstriction and the severity of the attack, since patients' perceptions of the seriousness of their symptoms may vary.[19] **In younger children measurement of PEF is not possible**, however a combination of increased daytime cough, daytime wheeze and night-time β_2 agonist use has been found to be a strong predictor of an exacerbation; critical clinical features of a severe attack requiring immediate treatment include inability to talk in sentences and/or too breathless to talk or feed.[2,15,20] If a patient has signs and symptoms across categories of severity, he/she should be treated according to the most severe features.[3,5]

Management

The **aims of treatment are to relieve airflow obstruction and hypoxaemia as quickly as possible** and to plan the prevention of future relapses.[13]

Figures 4 to 6 outline the protocols for managing acute exacerbations of asthma in primary care according to age.[4,19,20] The management pathway is similar for each age group; the **main differences relate to (1) the clinical parameters which are useful in assessing severity and (2) the recommended dosage regimens according to age.**

For each group, a brief history and physical examination (which should be undertaken concurrently with prompt initiation of therapy) will indicate whether a patient requires immediate hospital admission.[4,19,20] **A lower threshold for admission should be considered** if (1) it is an afternoon or evening attack, (2) there is a history of recent nocturnal symptoms or hospital admission, or previous severe attacks, (3) if the patient or parent is unable to assess condition or (4) there are concerns over social circumstances.[4]

Figure 4: Management protocol for acute exacerbation of ADULT ASTHMA in primary care[4,13,19]

Assess Asthma Severity

Life-threatening asthma	Acute severe asthma	Moderate asthma	Mild asthma
PEF<33% best or predicted. SpO_2 <92%. Exhaustion, confusion, coma. Silent chest, cyanosis, poor respiratory effort. Bradycardia, arrhythmia, hypotension.	**PEF 33-50% best or predicted.** Cannot complete sentence in one breath. RR>25 breaths/min. PR >110 beats/min.	**PEF 50-75% best or predicted.** Talks in phrases. Prefers to sit. RR<25 breaths/min. PR <110 beats/min. Loud wheeze.	**PEF >75% best or predicted.** Speech normal. Can lie down. RR <20 breaths/min. PR <100 beats/min. Mild-moderate wheeze.
↓	↓	**Management** ↓	↓
Arrange immediate ED referral*	**Consider admission**	**Treat at home or in the surgery** **ASSESS RESPONSE TO TREATMENT**	
Oxygen (40-60% or higher if available) Prednisolone 40-50mg (or hydrocortisone 100mg IV) immediately. High dose β_2 agonist** *AND* ipratropium (0.5mg), • given ideally via oxygen-driven nebuliser **OR** • via spacer (up to 12 puffs, given one at a time and inhaled separately) • Assess response in 10-20 minutes and repeat as necessary (3 doses in total) while awaiting transfer to hospital	Oxygen (40-60% or higher if available) Maximise the dose of β_2 agonist** • given ideally via oxygen-driven nebuliser **OR** • via spacer (up to 12 puffs, given one at a time and inhaled separately) • Assess response in 10-20 minutes and repeat as necessary (3 doses in total). If PEF >50-75% predicted/best: prednisolone 40-50mg (or hydrocortisone 100mg IV). **If good response** to first nebulised treatment *(symptoms improved, RR and PR settling and PEF >50%)* continue step up usual treatment and continue prednisolone*** Arrange GP review within 2 days **If no / poor response** ADMIT*.	Maximise the dose of β_2 agonist** • via spacer (up to 12 puffs, given one at a time and inhaled separately) **OR** • via oxygen-driven nebuliser • Assess response in 10-20 minutes and repeat as necessary (3 doses in total). If PEF >50-75% predicted/best: prednisolone 40-50mg (or hydrocortisone 100mg IV). **If good response** to first nebulised treatment *(symptoms improved, RR and PR settling and PEF >75%)* continue step up usual treatment and continue prednisolone*** Arrange GP review within 2 days **If no / poor response** consider ED referral	Give up to 12 puffs of regular inhaled bronchodilator therapy via spacer. Prescribe inhaled steroid. Follow-up treatment as per maintenance treatment guidelines**** Arrange GP review within 2 weeks

*stay with patient until ambulance arrives; send written assessment and referral details; repeat high-dose bronchodilator therapy via oxygen-driven nebuliser in ambulance; **salbutamol 5mg; *** prednisolone 40mg/day X 5 days; ****see Bulletin on Management of Asthma (Part 1).
PEF=peak expiratory flow; RR=respiratory rate; PR=pulse rate; SpO_2=oxygen saturation; ED=emergency department

Figure 5: Management protocol for acute exacerbation of childhood asthma (6-15 YEARS) in primary care[4,20]

Assess Asthma Severity

Life-threatening asthma	Acute severe asthma	Mild or Moderate asthma
PEF <33% best or predicted SpO_2 <92% Silent chest Poor respiratory effort Agitation Altered consciousness Cyanosis	**PEF <50% best or predicted** SpO_2 <92% Too breathless to talk RR >30 breaths/min PR >120 beats/min Use of accessory neck muscles	**PEF ≥50% best or predicted** SpO_2 ≥92% Able to talk RR <30 breaths /min PR ≤120 beats /min
↓	**Management**	↓
Arrange immediate hospital admission*	**Consider hospital admission**	**Treat at home or in the surgery** **ASSESS RESPONSE TO TREATMENT**
Oxygen (via facemask if available). Nebulise β_2 agonist** *PLUS* ipratropium 0.25 mg. [Use spacer if nebuliser not available]. Soluble prednisolone 30-40mg (or hydrocortisone 100mg IV) **Repeat β_2 agonist according to response to treatment while awaiting transfer to hospital**	Oxygen (via facemask if available). β_2 agonist ** • via spacer (up to 12 puffs given one at a time and inhaled separately) **OR** • via nebuliser** • Review and repeat if necessary after 20 minutes (3 doses in total). Soluble prednisolone 30-40 mg. **If good response:** • Continue β_2 agonist (via spacer or nebuliser**) as needed but not exceeding 4-hourly • Continue prednisolone*** • Arrange GP review within 2 days **If poor response:** repeat β_2 agonist and arrange admission*	β_2 agonist • (up to 12 puffs via spacer + facemask). • Review and repeat if necessary after 20 minutes (3 doses in total). Consider soluble prednisolone 30-40 mg. **If good response:** • Continue β_2 agonist (via spacer or nebuliser**) as needed but not exceeding 4-hourly • Continue prednisolone*** • Arrange GP review within 2 days **If poor response:** repeat β_2 agonist and arrange admission*

* stay with patient until ambulance arrives; send written assessment and referral details; repeat β_2 agonist therapy via oxygen-driven nebuliser in ambulance; **salbutamol 5mg; ***prednisolone 30-40mg/day X 3 days. PEF=peak expiratory flow; RR=respiratory rate; PR=pulse rate; SpO_2=oxygen saturation

Figure 6: Management protocol for acute exacerbation of childhood asthma (2-5 YEARS) in primary care[4,20]

Assess Asthma Severity

Life threatening asthma	Severe exacerbation	Mild/moderate exacerbation
SpO_2 <92% Silent chest Poor respiratory effort Agitation Altered consciousness Cyanosis	SpO_2 <92% Too breathless to talk RR >50 breaths /min PR >130 beats /min Use of accessory neck muscles	SpO_2 ≥92% Able to talk RR <50 breaths /min PR ≤130 beats /min
↓	**Management**	↓
Arrange immediate hospital admission*	**Consider hospital admission**	**Treat at home or in the surgery** **ASSESS RESPONSE TO TREATMENT**
Oxygen (via facemask if available). Nebulise β_2 agonist** *PLUS* ipratropium 0.25 mg. [use spacer if nebuliser not available]. Soluble prednisolone 20mg (or hydrocortisone 50mg IV). **Repeat β_2 agonist according to response to treatment while awaiting transfer to hospital**	Oxygen (via facemask if available). β_2 agonist • via spacer (up to 6 puffs given one at a time and inhaled separately) **or** via nebuliser** • Review and repeat if necessary after 20 minutes (3 doses in total). Soluble prednisolone 20mg. **If good response:** • Continue $\beta_2$agonist (via spacer or nebuliser) as needed but not exceeding 4-hourly • Continue prednisolone • Arrange GP review within 48 hours **If poor response:** repeat β_2 agonist and arrange admission*	β_2 agonist • (up to 6 puffs via spacer and facemask). • Review and repeat if necessary after 20 minutes (3 doses in total). Consider soluble prednisolone 20 mg. **If good response:** • Continue $\beta_2$agonist (via spacer or nebuliser) as needed but not exceeding 4-hourly • Continue prednisolone • Arrange GP review within 48 hours **If poor response:** repeat β_2 agonist and arrange admission*

* stay with patient until ambulance arrives; send written assessment and referral details; give β_2 agonist therapy via oxygen-driven nebuliser in ambulance;
** salbutamol 2.5mg; ***prednisolone 20mg/day X 3 days. RR=respiratory rate; PR=pulse rate; SpO_2=oxygen saturation

Follow-up

Once the exacerbation has settled down, patients should be reviewed by their primary care physician within 2 working days if possible, in order to assess their current status and discuss the potential triggers to the recent acute attack.[1,4] This visit should be used to review (1) their treatment regimen (to check adherence to medication, inhaler technique and potential need to step up or down therapy) and (2) their understanding of asthma (or that of the parents in the case of a child with asthma), in order to re-educate and/or amend the written asthma management plan as needed.[19,20]

SUMMARY POINTS FOR THE MANAGEMENT OF ASTHMA IN PRIMARY CARE

Effective management of asthma, a chronic inflammatory condition, involves 4 interrelated components: [1,4,21]

- Develop doctor-patient/parent partnership
- Identify and reduce exposure to risk factors in the individual patient with asthma
- Assess, treat and monitor asthma using an agreed written asthma management programme and regular structured reviews
- Manage asthma exacerbations according to the age-appropriate management protocol

The ICGP guidance document "Asthma Control in General Practice" contains a flowchart that summarises the asthma structured review process (**http://www.icgp.ie/go/library/icgp_publications**).

List of references available on request. Date of preparation: February 2014

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